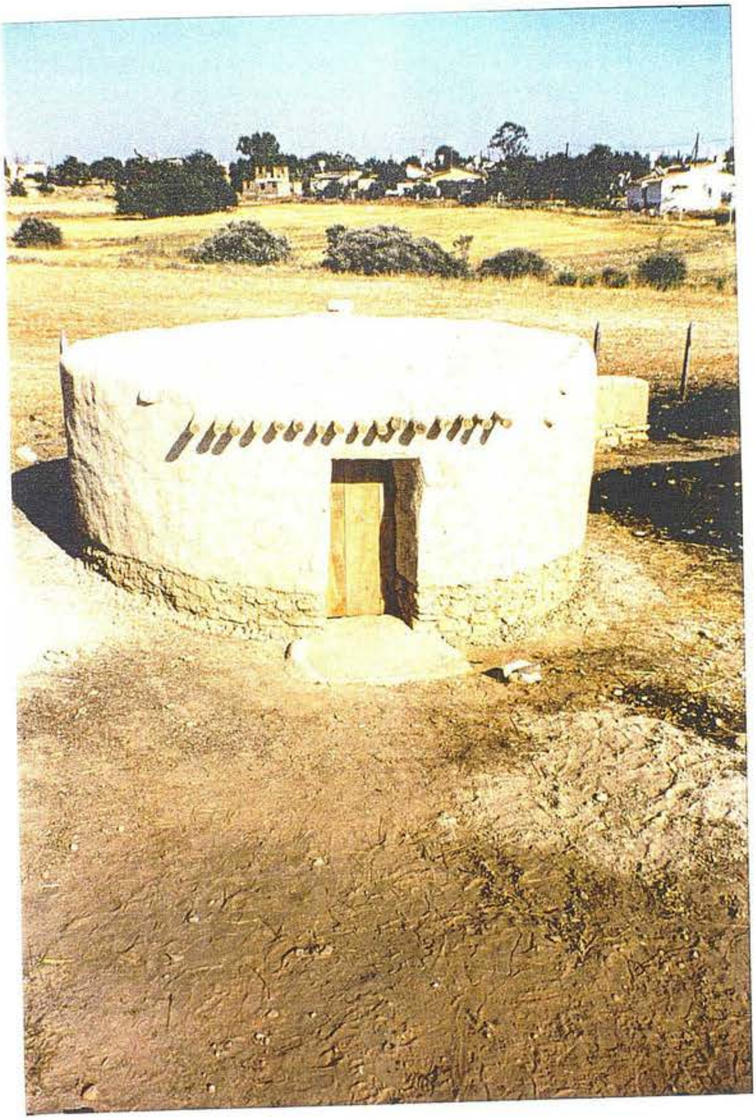
Prehistoric Cypriot Mud Buildings and their Impact on the Formation of Archaeological Sites.

by Gordon D Thomas



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Declaration.

I declare that this thesis has been composed entirely by myself and that the work for it has been carried out by myself as part of my research or under my direct supervision as a member of the Lemba Archaeological Project.

Gordon D Thomas
September 1995.

Acknowledgments.

Much of the help that was given to me during the course of this research is acknowledged in the text at the appropriate places. What is not shown is the friendship, enthusiasm and encouragement which so much form part of the fieldwork and drive behind such a project. I can only say with thanks my debt of gratitude to Kenny Aitchison, Elspeth Alexander, Derek Alexander, Patrick Begg, Diane Bolger, Paul Croft, Kevin Craw, George Findlater, Louise Maguire, Mary-Anne Murray, Alistair Rees, Jenny Shields, Dave Sewel and the many students who helped at various stages in the work at the Lemba Experimental Village.

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My thanks are due to all these people.

Gordon Thomas.

Abstract.

The current research grew out of work on the Erimi Culture sites in the west of Cyprus at *Lemba* Lakkous, *Kissonerga* Mosphilia and Kissonerga *Mylouthkia* dating from c3500-2500/2300 B.C. The need to understand the nature of the archaeological deposits and the buildings which form the largest element of those deposits channelled the research along four main paths or aims: 1) the characterisation and classification of all Chalcolithic building elements setting them within a proposed scheme of building types, 2) the establishment of these within the framework of Middle Eastern building traditions with an indication of any cultural links, 3) the identification and characterisation of prehistoric building deposits and materials and, 4) the contribution of some thoughts to the understanding of site formation processes. Three avenues of study were followed. The first involved an investigation of the behaviour of the key elements of soil, clay and lime in order to be able to characterise building materials. A study of the archaeological evidence was then undertaken and a scheme for classifying building elements proposed. This was tested in the second avenue of study through experimental reconstruction at *Lemba* in which comparative modern materials and building types were examined. Further comparative material was obtained from the study and excavation of the recently abandoned village of *Souskiou*, this being the third avenue of study. This has also been used to identify ways in which buildings collapse or decay and become part of the archaeological record. From these studies a reference collection of comparative building materials and deposits is being assembled and used to explain prehistoric remains.

In the final discussion, eight Chalcolithic building types were identified and described. The development of house form is also discussed and the emergence of two very characteristic building types, the courtyard house and the temple/shrine is proposed. A tradition stretching back into the Neolithic of Cyprus and the southern Levant is suggested with key architectural traits being highlighted. The significance of the lime plaster industry is also discussed in its Middle Eastern context. Finally, the key characteristics for identifying common building materials are described. This can be achieved using a hand-held, calibrated 10x magnification lens and is easily accessible to all field archaeologists. The understanding of site formation processes is a much longer term aim but initial results from the experimental work at *Lemba* and from the studies at *Souskiou* are presented.

Prehistoric Cypriot Mud Buildings and their Impact on the Formation of Archaeological Sites.

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Chapter 1: Introduction.

1.1 The Purpose and Background to the Research.

The Lemba Archaeological Project[1] was established in 1976 with the initiation of excavations at the site of *Lemba* Lakkous and few years later at Kissonerga *Mylouthkia* and *Kissonerga* Mosphilia. The overall project was always regarded as a broadly based research initiative seeking to examine in depth, and within a wider geographical setting, the nature of the Chalcolithic period in Cypriot prehistory (Peltenburg 1983). To this end a number of different approaches have been adopted including excavation, survey, artefact studies and specialist analysis. The investigation of the buildings of the period is an aspect of the overall aims of the project which is long overdue for investigation and which this study hopes to rectify in some small way.

The production of three major excavation reports, two published (*LAP* 1, and *LAP* 2.2) and one in the process of completion, has highlighted some of the short-comings in our treatment of the buildings of the sites under excavation and has indicated the depth of ignorance about the very deposits we were excavating. At both *Lemba* and *Kissonerga* questions about the context of finds and deposits are crucial for the interpretation of the sites and, in the process of producing excavation reports, it quickly became apparent that this could only be answered by understanding the history of site formation. Material lying on the floors of buildings could, for example, be there for a number of reasons ranging from the catastrophic collapse of the structure to deliberate or ritual placement, or to post-occupation usage. In many cases buildings were seen to be selectively preserved with sections of floor, walls and contents surviving in remarkably good condition in contrast to the almost total destruction of the rest of the building or to other structures where only the faintest of traces belied their former existence. Clearly, different agencies were in play acting upon these buildings and it was of some importance to an understanding of the site that these be identified. These, and the interpretation of elements of individual buildings were some of the considerations which arose from the preparation of the site reports. They highlighted our lack of knowledge about sites and buildings and to the lack of any overall framework within which to understand the nature of archaeological site formation. Buildings are human artefacts created by and for people. An understanding of these artefacts must surely be crucial to our understanding of how the site developed and of the context of every other artefact and deposit on that site.

Far reaching interpretations can be derived from the excavation of buildings based not so much on a thorough and objective analysis of the evidence as on preconceived notions of human behaviour and use of buildings. For example, when applied to buildings the use of terms like "collapse", "destruction", "erosion", or "wash deposits" imply very specific processes which have very clear implications for the history of the site. They also imply quite specific interpretations about

[1] Hereafter referred to as LAP.

the social and cultural behaviour of people in prehistory and can be used for creating a "history" of the period. Closer examination, however, can indicate that these terms have been used inappropriately and reflect an inadequate understanding of the site itself. Experimental work at *Butser* in England (Reynolds 1979) and *Ljere* in Denmark has demonstrated the danger of such inappropriate usage where ordinary domestic occupation can generate deposits identifiable as the result of "destruction" and where, conversely, known destructions can leave surprisingly few clues about the end of a structure (Harding *et al* 1993). There is also a tendency within the publication of site reports for the casual and very loose application of quite specific architectural and constructional terms in a manner which belies a lack of understanding of the excavated structures themselves. Terms such as pisé, tauf and plaster are commonly used in archaeological reports in totally inappropriate contexts. Part of the difficulty is the failure to develop a set of suitable terms which do encompass the range of variation which can be present in mud architecture and to indicate ways in which they can be distinguished. The classification of the various forms of mud construction and the identification of destructional processes which act upon these structures as well as the development of a method of understanding and describing archaeological deposits was one aim of this study. It has, of course, specific importance for the sites of the Chalcolithic of Cyprus but it is hoped that such an approach can also have a wider relevance for other Middle Eastern excavations.

At the outset of this research it was evident that a broadly based approach was needed to contend with the severe limitations of our knowledge of primitive buildings and archaeological deposits. Three main areas of study were devised to accommodate this need: the study of the archaeological material itself and, the creation of a comparative reference collection of building materials derived from experimental archaeology and ethnoarchaeology. The archaeological sites themselves, of course, supplied the basic data and constraints within which the questions were posed and the theories tested. They also provided the archaeological samples for a study of the various elements and materials which comprised the buildings. This is described in chapter 3. The identification of the archaeological materials was carried out through an understanding of the behaviour of soils and clays (outlined in chapter 2) and by comparison with known modern materials and deposits. This latter aspect was achieved by investigating a recently abandoned village where it was possible to identify specific building structures and processes of collapse which were related to the deposits around the building (appendix 2). The experimental village provided an alternative method of creating known modern material for comparison with prehistoric deposits and materials (chapter 4). It also provided a laboratory for testing out ideas about those materials and building forms. These, then, are the three main areas of study: 1) the archaeological remains, 2) the ethnoarchaeology of modern building collapse and site formation[2] and, 3) the experimental testing of ideas about buildings and materials.

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[2]For the purposes of the present work the ethnoarchaeological approach is still considered to be in fairly early stages of development and, although some results are forthcoming and are included in the discussions, the main report has been placed as an appendix where it is available for consultation.

Much of the material which is included in this report has been derived from empirical observation in all three areas of study. This evolved not as a deliberate policy but as the only available option: there are no studies of the type which is being attempted here. Although soil analyses and sedimentological studies have been used extensively in archaeology there have been few comprehensive works dedicated to the identification of specific events and constructional processes, particularly when applied to the Middle East. The work of Courty *et al* (1989) was only ever considered as a general introduction and guide with the understanding that most of the characterisation and descriptive work had still to be done for individual areas and sites. Similarly, apart from Ionas' (1988) study of Cypriot vernacular building traditions very little else had been done in the way of recording and studying traditional Cypriot architecture while no work has been carried out into understanding the impact of these buildings on the formation of archaeological sites. With experimental archaeology there was a much firmer basis of groundwork and procedures although, again, this has never been attempted in the Middle East. Some of the issues and methods surrounding these approaches will be discussed below.

1.2 The methods used: Experimental Archaeology.

An elaboration of the theme of analogy in archaeology is the creation of new analogies through the process now known as experimental archaeology. Coles (1973, 13) describes this as a "*...collection of facts, theories and fictions that has been assembled through a century of interest in the reconstruction and function of ancient remains.*" He suggests that the term "experimental" implies a trial, a test or means of judging an idea or hypothesis. Hodder (1982, 22) disputes the value or ability of archaeologists to prove or disprove an hypothesis through testing suggesting rather that a more suitable approach for archaeological science is to lend support or to increase probability in the reliability of any particular idea. I tend towards this latter view of any scientific approach in archaeology preferring to take the more pragmatic attitude that there are no absolutes when dealing with past human behaviour. Reynolds (Harding *et al* 1993, 94) cautions against the use of analogous interpretation as being "*...the most attractive, but yet the most dangerous and potentially spurious method of understanding the remote past.*" However, if we adhere to the view that analogy through experiment only serves to strengthen a proposition rather than to prove it, then this difficulty becomes less imperative provided a suitable intellectual distance is maintained from the interpretation.

Experimental archaeology should not, therefore, be considered along the lines of a scientific experiment. It is the logical outcome of the way in which archaeology has developed through its use of analogy and has its own set of criteria and aims. This does not diminish its value as an experimental procedure but, rather, validates its position as a tool of research unique to archaeology. All experiments follow roughly the same path progressing from a problem, to an idea or hypothesis which is then examined by reconstruction from which results are collected before being assessed. Coles defines eight rules which form the basis of good procedural and common sense practice (1973, 15ff). They are worth reproducing here in Coles' own words (*italics*) with an indication as to how the current series of LEV experiments have fared in this respect.

1. *The materials used in the experiment should be those considered to have been locally available to the ancient society that produced the problem.* With all the reconstructions at *Lemba* careful consideration was made to ensure strict adherence to this rule where possible, the only exception being the acquisition of timber which is discussed under the relevant section. Analyses carried out on ancient materials has also helped to determine the nature of those materials and the methods used to manipulate them during the preparation and construction processes.

2. *The methods used in the experiment to reproduce ancient materials should not exceed those presumed to have been within the competence of the contemporary society.* Again with work at *Lemba* care has been taken to ensure such limitations be observed in most cases. The level of technology achieved in prehistoric Cyprus is fairly well understood with detailed studies and classifications of tools, ceramics and trade patterns indicating the abilities of ancient society. The use of modern tools during the construction process in particular is thought to be influential in the final outcome and was strictly limited although difficulties with long distance supervision of the project has meant this has not always been observed. This problem is indicated where relevant but applies mainly to **RH1**.

3. *Modern technology should not be allowed to interfere with the experimental results, but should not be neglected in furthering our understanding of the materials used and the methods used to alter them.* Under this stricture all activity involved with the acquisition and preparation of the materials and the construction of the buildings should be carried out by hand using only Chalcolithic tools and containers. This, of course, presupposes that all aspects of the building process are being studied. In the case of the *Lemba* reconstructions they were not. It is argued that a single exercise in felling a tree or digging a pit is sufficient to demonstrate that the acquisition of these materials would be possible using primitive technology and that a study which is involved primarily with the construction of the buildings and the formation of archaeological deposits should concentrate on those aspects alone. Obviously, considerations of total labour investment will not be possible outside the strict limits of the actual construction process. The second part of Coles' guideline indicates that modern analysis and the equipment necessary to carry it out should be used without hesitation and without fear of invalidating an experiment.

4. *The scope of the experiment should be assessed before work begins.* Here Coles is stressing the need to marry the desired outcome of the experiment with the methods by which it is carried out. Considerations of time or studies of erosion and collapse, for instance, demand a strict adherence to faithful methods of construction using appropriate materials and tools. This is the design element of any serious research project and is the basis of the current research. The establishing of specific house types and the testing of details of construction were part of this program.

5. *The experiment should be repetitive if possible, each building on the results of the previous test.* The series of buildings at *Lemba* did draw on the expertise and mistakes made in previous

structures particularly with regard to the mud walls and the roofs. The repeated firings of the lime kilns also developed and improved with each firing.

6. *The experimental work will be undertaken with the desired result in mind, but there should exist a genuine uncertainty that the method adopted will succeed, and improvisation should be constantly considered.* Considerations of different types of earth walling and details of construction were necessary precursors to any of the reconstructions and the caution, not to mention the trepidation, with which the builders greeted their completed houses argue eloquently for a genuine uncertainty. In any reconstruction commencing from scratch improvisation is an essential input from all workers and was encouraged on the various projects provided adequate recording and observations were made.

7. *The results of the experiment will consist of a series of observations that lead the archaeologist to certain suggested conclusions.*

8. *Finally, the experiment should be assessed in terms of its reliability, that it asked the right questions of the material, that the procedure adopted was appropriately conceived and honestly applied, and that the results were observed and assessed fairly.* These latter two aspects of the research are covered in the finishing chapter but are part of the longer term considerations of the project as a whole. While certain aspects can and should be assessed now others must wait until the longer term aims of site formation studies have been realised.

These, then, are the general principles or rules which guided the course of work with the experimental reconstruction of five roundhouses at *Lemba*. One final consideration, however, must be addressed. Reynolds in his description of the reconstruction of the *Pimperne Down* roundhouse at *Butser* (Harding *et al* 1993, 93ff) argues quite forcibly for a strict adherence to the creation of a faithful replica of a specific building on the grounds that it is only by doing so that anomalies in the evidence will be resolved. Indeed, he was able to achieve this by demonstrating a function for shallow grooves along the outer edge of the building and for the pattern of postholes at the entrance. However, his exclusion of some of the evidence until the reconstruction demanded its inclusion is slightly unsettling. There is also his admission of evidence from other excavated structures which, strictly, should not be allowed under his own constraints. Reynolds' approach does emerge from a legitimate and useful principle, but it does presuppose certain considerations about the construction process which may make it invalid for other reconstructions. He ignores the flexibility which the builders must have exercised in respect to their materials; for example, the positioning of some postholes on the plan may reflect an unequal size and shape in the available timbers rather than a specific design element. Although a location generally similar in its local topography to the original site was chosen for the reconstruction we cannot ignore the possibility that specific structural details were in response to conditions which exist only at the original site. In the *Pimperne* renconstruction these considerations were trivial but they do suggest grounds for difficulties with future work. Smith (1982, 13) sums this up when he states that "*...by following the evidence literally we may be implying an irrationality on the part of the builders which we would vigorously deny in relation to topics for which there is fuller evidence.*" A slightly different approach, therefore, was adopted with the *Lemba* reconstructions where a wealth of evidence from the excavated sites of *Lemba* and *Kissonerga* provided information from a number of buildings about various aspects of particular building types. No one building provided all the evidence and no two ground plans were identical although overall similarities could be detected. An analysis of all the different building elements combined with a study of building materials[3] and the development of a classification system[4] allowed the creation of type constructs which could be used as models for the construction of building replicas. Although no reconstruction reflects in detail the groundplan of any single building they do remain faithful to the individual types[5] and, as such, are workable units of study.

1.3 The methods used: Building Materials Study.

The value of a geologist or sedimentologist on site has long been an acknowledged but, sadly, rarely achieved goal of excavation. Cornwall (1958) and Shackley (1975) alerted the archaeological community in general to the many advantages of the type of understanding a sedimentologist can bring to a site and both also outlined the sorts of procedures and analytical studies which could be carried out. Basic soil evaluation studies such as particle size analysis or mineralogical and chemical analysis have been shown to be of enormous value in understanding not just the stratigraphy of a site but also larger issues as well. Davidson (1973), for example, was able to use a combination of particle size and phosphate (pH) analysis to investigate the development and evolution of a tell in NE Greece. Rosen (1986), using similar methods, characterised the soil used in the manufacture of mud bricks at Lachish in Israel and was able to identify the various sources that were used throughout the history of the site in relation to changing land use and environmental patterns. Dealing with the difficulty in identifying decayed mudwalls in the field McIntosh (1975, 1978) was successfully able to identify the eroded remains of the sites of mud buildings in W Africa through particle size analysis and fractional differentiation. When specific questions are being asked a comprehensive battery of tests and analyses are available to help the archaeologist and to add a further dimension to the quality and types of information which can be obtained from an archaeological site.

However, with their study of the importance of micromorphology in archaeology Courty *et al* (1989) demonstrate the ability of soil science to take this a stage further with the microscopic examination of the structure or micromorphology of archaeological sediments. Although it is not entirely new in archaeology, Cornwall (1958) was the first to apply it to an archaeological situation, it has been largely ignored due to its inaccessibility and expense. This type of study stresses the important information which can be obtained from examining archaeological material while its structure is still intact and before any physical or chemical studies have been carried out on it. While acknowledging the value of the analytical methods they point out that such an approach would "*... fail to unravel the compound effects of two successive events (be they geological, archaeological or*

[3] See the discussion of these aspects in Chapter 3: The Archaeological Material.

[4] This is covered in the discussion in the final chapter.

[5] Although, see the discussion of the individual roundhouses for limitations on this aspect.

pedological) superimposed on the same material." (1989, 5). Soil micromorphology is studied with the aid of thin sections taken from *in situ* archaeological deposits which are examined to identify microscopic materials like plant remains and to distinguish and characterise structures within the formation of the soil itself.

Many of the aspects which are examined in a micromorphological study are the same as those employed to characterise aspects in ordinary soil evaluation studies. Their use lies in the knowledge of how sediments, minerals and chemicals behave under differing conditions creating distinct formations which are specific to pedological, geological and anthropogenic agencies. Courty *et al* outline in adequate detail the various procedures to be followed and aspects to be studied. The following characterisations are based upon their outline for the study of micromorphology.[6] However, one of the principle aims of the present research was to develop a system of identification for building materials and archaeological sediments which could be more readily used in the field. The cost of large scale sampling and the laboratory time expended on it can have a detrimental effect on the willingness of archaeologists to undertake such evaluations in the face of more immediate pressures. If this could be carried out more readily in the field by the archaeologists themselves with an aim to identifying materials by hand, so to speak, and with an aim to identifying key deposits or sections which would benefit from laboratory treatment, then it is likely that more programmes of sedimentological studies would be carried out. Accordingly, the range of characterisations has been narrowed down to those key elements which can be identified using a hand held lens. They are as follows:

1. <u>Thickness</u> of the deposit as well as other relevant dimensions.
2. <u>Boundary</u>. The distinctness and type of boundary between the various identifiable units as well as the surface detail about any discrete or clastic element is informative. Boundaries can be of 12 types[7] and are based on depositional/sedimentological processes, soil forming or pedological process, anthropogenic processes and combinations of all three. Each of these is further subdivided according to the clarity or gradation of the boundary. In dealing with anthropogenic deposits and building materials in particular we are often confronted with deposits which existed above ground, for example, mud bricks/wall, plasters, hearths, basins etc. With these it is necessary to enter into considerations of surface treatment which will be structured differently from the internal fabric of the material due to its exposure at some point to other processes.
3. <u>Colour and variation</u>. This can most objectively be achieved using a Munsell Soil Colour chart testing on slightly dampened soil in muted natural light. However, internal variations and subtle colour changes are generally much more informative than differences between soils from different contexts. Each site or area will tend towards a specific colour range and it is the divergences from that range which will indicate important distinctions.

[6]This is by no means an exhaustive and detailed list of all aspects recommended for study by Courty *et al* but is merely those characteristics which can be accommodated within the present study which stresses field identifications. For a fuller treatment the reader is referred to Courty *et al* 1989, Shackley 1975 and Cornwall 1958.

[7]See Courty *et al* (1988) 34 for a complete description of these boundaries.

4. Texture and stoniness. Texture refers specifically to the relative proportions of the various groups of soil grains (sand, silt, clay) which are smaller than 2.0mm in diameter while stoniness deals with material larger than this (gravels fine and coarse, pebbles, and stones). Each class of particle size behaves in different ways and conditions much of the activity of the deposit. The clays and finer silts in particular are important in this respect and are dealt with below. Considerations of roundness and grain shape can also be dealt with in this category. These can distinguish the depositional process which brought the sediments to a particular locality. Wind blown sediments, for example, are very fine and tend to be more rounded in comparison to sediments which have travelled shorter distances.

5. Bedding and sedimentary structures. This refers to the organisation of the sediments within a deposit or feature and can affect all the depositional elements within that deposit. Massive bedding occurs when deposits are laid down in thick layers with very little internal differentiation which only becomes apparent under the microscope. Laminated bedding is visually distinct as a series of finely structured consecutive layers which can result from a variety of flow conditions. Cross bedding is composed of sets of laminated units reflecting a complex flow and depositional history. Lenticular structures can occur within these units. Graded bedding is distinguished by an upward decrease in grain size reflecting a decrease in energy during the deposition of the bed. Deformation structures occur after the initial deposition in response to further activity.

6. Microstructure. This deals with the shape, size and degree of development of the aggregation of the particles including sorting and orientation. Five main types of soil structure can be identified according to shape and these can be further characterised according to size and degree of development. These are granular, crumb, blocky, prismatic and platy. Within this observations of degree of sorting and orientation of particles should also be considered. Voids are an important feature in many archaeological sediments and materials. Their size, shape density and contents should all be recorded.

Using these main areas of characterisation to identify the distinguishing features samples of elements of buildings and their contents were collected and studied from the sites of *Kissonerga* and *Mylouthkia*. In addition, sections from excavations at *Souskiou* Village and from the reconstructions at Lemba Experimental Village[8] were also studied using the same criteria and methods. A hand-held calibrated lens of 10x magnification with a linear and density scale was the only equipment used. Apart from one sample no attempt was made to consolidate any of the material which was generally in a fairly robust condition surviving the trip to Edinburgh with a minimum of packing and surprisingly little damage. Particle size analysis was also carried in order to characterise the base soils and materials which were available in the area around the sites. The proposed system of identification of the different building elements and the significance placed upon those elements is based, again, on analogy derived from a study of materials and deposits at the abandoned village of *Souskiou* and from a familiarity gained with these materials during the various experimental reconstructions at *Lemba.*

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[8] Hereafter cited as LEV.

1.4 The course of the research.

This research was initiated in 1988 as a part-time programme of work. By the time it was initiated the excavations at the site of *Lemba* Lakkous had been completed and published as the first volume in proposed series of LAP publications (Peltenburg *et al* 1985a). Work had already been started on the site of Kissonerga *Mylouthkia* which operated in tandem with the *Lemba* excavations for several years but was suspended until September 1994 when three more seasons of excavation were launched. This is due for completion in September 1995 with a proposed publication scheduled within the next year or two. The bulk of the excavation on the much larger site of *Kissonerga* Mosphilia took place between 1982-1990 with the publication of the contents of pit 1015 appearing in 1991 and the publication of the rest of the site due to appear in 1996. The timing of the research and the excavations has meant that only a short three year span existed during which buildings under excavation were available for study. Pressures of full-time work also precluded participation on several of the seasons of excavation. However, several important building sequences were investigated at *Kissonerga*, mainly in the lower field, and the discovery of the buildings at *Mylouthkia* was a great bonus to the study. These latter were the only buildings from the early Chalcolithic (EChal, period 2) which have been studied. Period 3b is much better covered from *Kissonerga* with period 4 only just being represented. Work at the Lemba Experimental Village was also commenced, probably slightly prematurely, in 1988 with the start of the construction on **RH1**. In retrospect, a period of study into building materials and building types should have proceeded any such activity on the site although the advantages gained from an early start marginally outweigh the mistakes which were made.

These two considerations of timing and distance of study have placed major constraints on the course of the current research. It has been difficult to carry out close supervision of some of the experiments at LEV and impossible to initiate any programme of continuous monitoring and observation of the results. It has also meant that some of the experimental work and reconstruction has not been carried out within the correct parameters. These are indicated in discussion where relevant. The final seasons of excavation at *Kissonerga* were geared towards specific goals and problems which did not readily lend itself to the inclusion of a further course of research which needed to be tested and developed. The programme of sampling and study of site formation should, ideally, have been introduced in the early seasons of excavation at *Kissonerga* and the inability to do so has placed limitations on the overall value of the site. The failure to record and sample any major section on the site or across all but two buildings and the damage done to buildings by weathering and insensitive restoration before adequate sampling had been carried out has resulted in a great loss. However, these do not detract from the outcome of the research, they merely define its parameters and limitations and indicate where improved, more informative work can achieved.

To summarise, then, the aims of research are fourfold: 1. To classify and characterise all Chalcolithic building elements from Cyprus and from them to identify a set of architectural forms or building types. 2. To establish these within the overall framework of Middle Eastern building traditions and to demonstrate links or themes which can indicate a common cultural tradition. 3. To identify and characterise building deposits and building materials in a manner which could be useful under fieldwork and excavation conditions. 4. To contribute some thoughts to the understanding of site formation and, hence, to site interpretation.

The first two of these goals can be achieved through standard archaeological fieldwork methods and the consultation of the available literature. It is proposed that the advancement of the latter two goals be made by comparison with modern traditional architectural materials and by the experimentation with building materials. From these deductions will be made concerning the nature and predicted form of building materials and deposits. Such an hypothesis can only be tested in excavation and can only be validated by increasing the number of observations derived from those excavations. The excavations at *Souskiou* provide one avenue of control in which an architectural and destructional history of a building is linked to the deposits forming within and around it. Clearly, further excavations will also need to be carried out in order to increase the data base. Prehistoric material from *Kissonerga* Mosphilia and Kissonerga *Mylouthkia* will also be used to strengthen and to test the hypothesis.

The thesis will develop, firstly, by considering the behaviour and properties of soil and clays, (chapter 2) which can then be used to describe and characterise the archaeological building material (chapter 3). A full description and scheme for classifying that material will also be presented in chapter 3. The proposals, arising from this scheme, that certain building elements and building types were constructed in specific ways using specific materials will be tested in chapter 4 in which the experimental work is considered. The issue of site formation will be considered within the study of building decay at the village of Souskiou (appendix 2) which will then be tested further with excavation and recording at the Lemba Experimental Village (chapter 4). Finally, the results and conclusions of the four main aims will then be discussed in the final section, chapter 5.

Chapter 2: Soil and Mud Construction

Every particle of dust on a patch of earth
Was a sun-cheek or brow of the morning star;
Shake the dust from your sleeve gently-
That too was a delicate, fair face.

Rubaiyat of Omar Khayyam 58

2.1 Soils

Soil or earth is the principal medium from which all mud or soil constructed buildings are formed. This is also one of the principle features of all prehistoric Cypriot architecture. The behaviour of soil and the different processes which act upon it condition the nature of all archaeological deposits. Therefore, before entering into a consideration of the archaeological material or an investigation of site formation processes, it is first necessary to discuss the various properties of soil and how it has been used by Man. This will be specifically with reference to the *Lemba* area although, in order to identify all types of earth construction it will be necessary to venture further afield. A general definition of soil must first be stated:

> *"....a natural body of mineral and organic constituents that results from the combined action of climate, organisms and man on a mineral or organic material."*
>
> *Courty et al 1989, 7*

This definition can also incorporate archaeological deposits and sediments which must be regarded as being subject to the same forces and processes as those naturally occurring soils. They must also be considered to be in a state of dynamic change. All soils are the product of local geological structures as well as prevailing and past weather conditions. A brief survey of these aspects will help with an understanding of soils within the *Lemba* area. Obviously, the geology, geographic history and weather are much more complex than it is possible to discuss here. For further information the reader is referred to works dealing specifically with those subjects (Christodoulou 1959).

Rock Types

The soils of the Paphos area, like all soils, are determined by the underlying geology of the region and by the prevailing climatic conditions. The bedrock of the area of *Lemba* and *Kissonerga* is "...a highly weathered, easily excavated, off white calcareous sandstone...locally known as havara." (Xenophontos, *LAP 1*, 6). Sandstone is a sedimentary, medium grained clastic rock consisting primarily of sand sized particles, in most cases quartz, bound together by calcium carbonate ($CaCO_3$). These rocks are laid down in marine conditions under which finely sorted sand particles accumulate forming a framework and matrix of sediment which is cemented together by precipitation of a mineral cement (calcium carbonate) into the pore spaces. The calcium carbonate is derived mainly from organisms which incorporate the mineral in their skeletons or from the supersaturated waters of seas, lakes and springs. As the name of the local rock, calcareous sandstone or calcarenite implies, calcium carbonate is a key element in the formation of this rock type and will be an equally important element in any material derived from the rock. The soils around both *Lemba* and *Kissonerga* have high concentrations of this mineral.[1] Other rocks are also found in the area and play an important part in considerations of available building materials. Under conditions in which the accumulation of organic skeletal material or the precipitation of carbonates is the primary method of deposition the various limestones or chalk are formed. In the *Lemba* area such rocks are found in the earlier Mammonia Complex formation which underlies the calcareous sandstone bedrock and outcrops in places where erosion or stream canyon formations have exposed underlying strata. All these rocks contain dense amounts of calcium carbonate and it is the behaviour of the carbonate minerals which is one of the key elements in understanding the exploitation of the local rocks and soils by prehistoric Man.

Climate

The climate of Cyprus is thought to have resembled that of the present, barring some variations, since the end of the last glaciation at around 10,000 years BP (Bottema, 1978). However, evidence for this is sketchy due to the paucity of intensive studies carried out in the region. Any general statements about past environmental conditions must, therefore, always be viewed with some caution. Both Bottema (1978) and Erinc (1978) are agreed, however, that relative post-glacial climatic stability had been achieved by around 10,000 BP although considerable variations can be detected within the overriding trend towards the present semi-arid conditions. It is likely, though, that the current soil conditions are the result of long-term processes which have been in operation for at least nine or ten thousand years. The closest meteorological station to the sites of the *Lemba* cluster is at Kato Paphos about 6km to the S. Records from the past twenty years show the region to have hot, dry summers with temperatures rising, on average, to 25-26°C during July and August and falling to below 14°C during December to February when much of the precipitation falls. Lying in the path of prevailing moisture-laden winds the Paphos area receives, on average, 422.6mm of rain per year, most of which falls as sudden downpours. Such a regime of dry, hot summers and cool, wet winters plays an important role in the formation of the soils of the region.

Local soils

Carbonate minerals ($CaCO_3$) are highly soluble and readily dissolve in carbonic acid (rain water) which gains in strength as it percolates through the soil by the addition of CO_2 from the bacterial decay of vegetation in the soil or on the surface. During the wetter winter months the chalks

[1] XRD analysis were carried out on various samples of materials from the sites of Lemba and Kissonerga as well as from the underlying soils. Although inconclusive they did indicate that the primary element of the soil was calcium carbonate.

and sandstones of the Paphos plateau are subject to chemical erosion which breaks down the rock structure by removing some of the calcium carbonate leaving behind impurities of quartz and clay. This leads to the development of a thin residual regolith which locally, is a reddish brown soil and makes a very poor medium for cultivation. It has a low organic content and a very poorly developed horizonal structure. The frequent winter downpours which give rise to the soil in the first place also subject it to continuous sheet erosion which ensures a thin, poorly developed soil cover. This is quite apparent on the small plateau area immediately overlooking the site of *Lemba*. It is not known how far an intact climax vegetation cover would have preserved the soil cover and allowed the development of a more mature soil structure. Certainly, on the basis of pollen studies at *Lemba*, Renault-Miskovsky (*LAP* 1, 306) can identify a relentless decrease in arboreal species during the lifetime of the site. It indicates that human occupation may have played no small part in the development of the soils over the past four or five thousand years through the destruction of the forest cover. This destruction has allowed clays and silts to be washed from the upper terrace or plateau to form thick deposits of sandy/clay colluvium along the coastal plain where most of the prime agricultural land is to be found. With such a thin and unstable soil cover the hot dry conditions of the summer also create very characteristic features in the geology of the area by leaching carbonate minerals dissolved in groundwater from the underlying rocks and clays and depositing them as secondary limestone caliche or calcrete-like formations at the soil/bedrock interface. These layers of almost pure calcium carbonate are known locally as kafkalla and they produce one of the most characteristic features of the landscape around *Lemba* and *Kissonerga.*

The soils, therefore, which existed in prehistory and which were available to ancient man were, on the whole, poorly structured, medium grained, sandy clays and marls with a high concentration of calcium carbonate and a very low organic content. Clasts of pure calcite and calcarenite were present in the regolith overlying the calcarenite of the terrace outcrops giving a very distinctive speckled appearance to the reddish/brown soil. This type of mixed soil structure is less apparent in the colluvial deposits along the coastal plains where deeper deposits of well sorted clay marls and gravels along the relict stream beds indicate a clear structure and more powerful depositional activity. It is this combination of calcareous bedrock (havara), marl and caliche (kafkalla) which constituted the primary building materials in prehistory.

The soils around the site of *Lemba* were subjected to sedimentation analysis in order to have an understanding of the base soil type from which all the archaeological remains and reconstructions were derived. Three groups of soil were studied as being the most common and readily available materials on the site; the more thoroughly sorted sediments of the river valleys to the N and S of the site were ignored as these were relatively small deposits and were sufficiently far from the site to make it unlikely that they were ever exploited in the building process. The soils which were analysed were; 1) the underlying calcareous sandstone (havara), 2) the reddish/brown regolith overlying the caliche outcrop to the N of the site, and 3) the anthropogenic soil cover overlying the site itself and lying within the surrounding fields. Various samples of 1 litre in volume were extracted from each of the soil groups mentioned and broken up to reduce any consolidated lumps. This was then passed through a 1mm mesh sieve to separate the sediments from any stones, pebbles or coarser gravels which were recorded as a percentage of the total volume of the sample. The sediments themselves were dissolved in 1 litre of water in a graduated cylinder and allowed to settle over 4 days. The resulting sediments were inspected and classed according to grain size using a hand-held calibrated lens of 10x magnification. These were then assigned a percentage of the total volume of the sample depending on the thickness of the deposited sediment within the cylinder.

Sediment type	Sample 1 (havara)	Sample 2 (red/brown)	Sample 3 (site)
clay	30%	9%	7%
silt	44%	32%	18%
sand	26%	25%	18%
gravel	-------	25%	57%
organics	-------	9%	--------

Table 1: Sedimentation analysis of soils from the Lemba site.

The two samples from the site and from the regolith overlying the kafkalla plateau are generally quite similar although the soil from over the site indicates a, not surprising, higher percentage of gravels and pebbles. This is most likely to be reflection of the human activity in the area which would tend to concentrate larger quantities of stone and stone-working debris on the site. They would fall into the category of a coarse sandy-silt. The high proportions of the coarser elements and the lack of structure within the soil can also be attributed to the severe erosion in the area and the long history of agricultural activity which would create a homogenous, poorly sorted and unstructured soil cover. The havara, however, is a very different type of soil which is most likely to be classed as a silty-clay. It exhibits a purity and fineness of sediment which indicates a natural undisturbed formation. This type of soil would have required very little processing or sorting in order to prepare it for any constructional activity.

These soils and bedrock derivatives are traditionally used for the construction of walls, the covering of roofs and as a surface render on walls. They have been used throughout the world and in the Paphos area in a variety of ways. Our understanding of why soil can be such a successful building material is often clouded by preconceptions and by a poor knowledge of local or vernacular traditions. Frequently, however, and despite the widespread development of earth construction in many parts of the world, the emergence of a local variant may be dependent as much on a knowledge of the behaviour of local materials than of association with related traditions. Each region develops its own methods and techniques of handling the local soils and of construction. The concept of the use of soil as a building material is transmissible cultural trait but the form of those buildings and the way in which the soil is used will be determined by the suitability of the local soils. In Cyprus, the geology has produced conditions which favour particular forms of earth construction and which appear to have been readily employed in prehistory.

2.2 Sediments.

There is some confusion in the archaeological use of the terms soil and sediment. For the most part, these are used interchangeably which has also been the case, so far, with the present work. There are, however, differences which should be considered. Soil, as defined earlier, has one further characteristic and that is the presence of distinct zones of activity within its structure creating horizonal differences. Leaching, gleying or organic decomposition are all forces which act together to produce the characteristics of the various soil groups. A sediment, on the other hand, is a collection of mineral or rock particles which have been weathered or eroded from their primary source and redeposited elsewhere (Shackley 1975, 1). The predominant forces involved in the creation of sediments are erosional for example; water movement or wind. The main difference between soil and sediment, therefore, is in the types of natural formation processes which dominate the deposit and in the presence or absence of an organic zone of deposition. If undisturbed, a sediment will be subject to the long term action of soil forming processes resulting in the formation of a soil structure and the loss of the original sediment structure. Under certain types of erosion, however, this soil structure will break down and deposits characterised by sediments will be reformed. It is clear then that archaeological deposits, by the nature of their formation, are both sediment and soil having been eroded or cast into a sedimentary formation which over time is subject to soil formation processes. For the purposes of this discussion, therefore, any archaeological deposit can also be considered as a sediment. This applies also to a soil or material which has been manipulated or altered for construction purposes. In this case the agent of change is human but the way in which the material behaves and the structures which develop typify all sedimentary processes. In constructional material, it is the scale and speed of deposition or formation which creates distinctive structures.

The nature and character of a sediment are determined by 1) the parent material, 2) the distance and method of its transport, 3) its final location and, 4) post depositional changes. Sedimentary deposition processes create structures within soils and sediments. In natural soil the structure is defined by the degree and nature of <u>cohesion</u> or aggregation of the particles while in sediments it is the <u>arrangement</u> of the particles. Archaeological deposits, and in particular materials which have been manipulated for construction, contain elements of both types of structure. Primary structures are those produced during the deposition of a sediment and can be identified by flow directional structures such as cross laminations, still-water silts or pebble imbrication where water is the primary source of deposition. Sediment rounding and sorting can give an indication of the force and extent of the action over large distances. Particle orientation and homogeneity is fundamental to understanding the rate of accumulation of deposits. Rapid deposition from a collapsed building will lead to randomly orientated particles with many larger fragments and clasts as well as frequent but irregular voids. Slower deposition action leads to the grading of particles and their orientation parallel to the slope of erosion. Clays and silts can be particularly useful in understanding the development of deposits because of their ability to form distinct laminated and platy structures which align at right angles to the direction of applied stress. Mud floors and surfaces are characterised by this aspect of clay behaviour. Wind deposited sediments are characterised by low bulk density fine particles which, on an archaeological site, may also include large quantities of ash.

Within soils altered for construction the primary structures are organised quite differently and include voids from the aeration of the mud, clay bridging structures between the particles and around the organics, and internal clay laminations which sometimes form patterns aligned along the direction of the mixing or moulding of the material. The act of mixing a soil for constructional purposes creates an artificially stable structure of randomly orientated particles of differing sizes with many irregular voids all held together by internal clay structures and bridges. These types of structure do not normally occur in nature on this scale.

Secondary deposition structures are formed after the forces of the initial sedimentary action are completed or, in the case of structural materials, after the material has been moulded or shaped into its final form. Illuvation occurs when water heavily charge with clay or silt penetrates a sediment or soil structure depositing the transported material along the voids or coating stones and peds with a clay layer. These can clearly be seen under low level magnification and can ultimately result in the infilling of all voids within the sediment. Carbonate saturated waters can also leave a similar type of structure. Biogenic structures are the result of insect activity and plant growth. These characteristically penetrate from the surface of the sediment or material and are usually manifest as clay lined channels from burrowing or decayed root development. More elaborate forms like larval cases constructed in fine clays can be mistaken for artefactual material. Some insect passages can penetrate quite deeply into the ground and can be identified by "..horizontal lenticular voids filled with illuvual clay and pillow-shaped faecal material.." (Wilkinson 1976, 283). A concentration of biogenic structures at an interface between two deposits can usually identify an earlier buried stable ground surface. Voids also develop in a sediment after deposition and can be an indication of the type of forces which since have been in action. The collapse or decay of organic material is an obvious source of these voids and can, at times, preserve the impression of the decayed material although it is frequently obscured by illuvial infill clays. Wetting and drying or freeze/thaw action can cause the particles to cohere in a regular structure creating many tiny air pockets.

2.3 Soil and Sediment Characteristics.

The characteristics of a soil and its behaviour are largely determined by the relative proportions of the clay, silt, sand, gravel and organic material from which it is composed. The first four are the mineral components of a soil and are differentiated from each other on the basis of grain size and structure. Clay particles are below 2 microns, silt 2-20 microns, sand 20 microns or 2.0mm, and gravel above 2.0mm (Torraca 1988, 100) (Keeley & MacPhail 1981, 228). Each serves a different function within the structure of the soil and can have a bearing on the way the material is used in the construction process both in preparation and in execution. They can also affect the post-occupational history of a building in quite dramatic ways.

Clay is a mineral composition formed from the weathering of several rock types producing minute particles of silicon (Si) and aluminium (Al). The basic structure of clay is the micelle crystal which is composed of several hundred leaf-like layers one atom thick of silica and aluminium. Three types of clay; kaolinite, illite and montmorillinite have this recognisable structure whereas a fourth, allophane, has no identifiable crystalline structure (Torraca 1988, 97-99). Kaolinite and allophane are rare and are, therefore, not considered here. Clay crystals are usually hexagonal in shape and are less than 2 microns in size. The two most common forms, montmorillonite and illite, are constructed of micelle wafers of silicon-aluminium-silicon bonded to the next wafer by water and calcium or potassium respectively. In montmorillonite the water bond is weak and variable but in areas where calcium or potassium are present illite is formed which has a much stronger structure. These clay wafers carry hydroxides or impurities of, for example, iron within their structures which are negatively charged (anions) and subsequently attract elements which are positively charged (cations). Cations of calcium, magnesium, and potassium are held in solution as colloids (minute particles) in ground water and bond to the outer surface of the clay wafers linking together clay micelle crystals into a cohesive mass . In the *Lemba* and *Kissonerga* area the groundwater will be very rich in calcium leached from the underlying calcareous bedrock making the clays in the area very strong and stable. Water, attracted by the hydroxy groups, is also able to penetrate the clay structure increasing the distance between the wafers causing the clay to swell. Increasing amounts of water allow the thin crystals of clay to slide over one another easily producing a very plastic material in which the crystals align themselves parallel to the surface forming a smooth, regular face. This can occur under both natural (e.g. rainfall or puddling) or controlled conditions (e.g. pot making). The addition of even greater amounts of water can break down the bond between the various clay crystals dispersing them entirely in solution. Under dry conditions the water is lost and the clay is first precipitated out and finally contracts as the water which has penetrated the clay crystal itself is also lost. The calcium bond between the clay crystals, however, is not destroyed in the short term and has indeed been improved as the crystals are organized into a more coherent, layered structure in which surface contact between the crystals has increased. It is the ability of the clays to form such coherent structures under the effects of water which produces their most distinctive characteristics- that is, plasticity and impermeability. These clay structures can be identified inside a mud mass as dense networks of very fine sediments coating and connecting the coarser elements. They can also form compact surficial deposits of very finely laminated structures formed by water deposition or artificial manipulation of the mud surface. Clays dissolved from a mud or soil fabric are deposited on the surface in these fine laminations as the water evaporates or as the energy flow of the water runoff is sufficiently reduced to allow precipitation.

The admixture of non-clay sediments and minerals with the clay does not seriously affect the strength or stability of its structure and can indeed be beneficial when considered for the construction process. Pure clays are rare and it is more likely that they will exist in conjunction with coarser grained sands and silts. These coarser elements can act as a stabiliser within a largely clay soil structure giving it a framework to bond in to and providing flexibility for expansion and contraction in response to temperature and moisture changes. During the complete disintegration of a soil through erosion or the decay of a structure the coarser minerals, being larger and heavier, are the last to be removed and are frequently deposited in the immediate vicinity of the area of origin. The finer and lighter clay and silt sediments tend to be carried further away during erosion and the various proportions of the finer and coarser sediments can give an indication of the energy of the processes involved in the erosion or breakdown of the soil or earth structure. An almost imperceptible gradation of elements over a short distance of 1.0-3.0m may indicate a continuous low energy process of erosion. This is seen most clearly at the bases of mud walls where the coarser sands and gravels accumulate directly at the foot of the wall with silts and finally clays spreading out gradually over several metres away from the structure. This is indicative of frequent, unhindered rainfall falling over several seasons and gradually breaking down the structure of the mud walls. High energy sheet erosion has more devastating effects with the various sediments being more clearly segregated and carried over greater distances where they are deposited in fairly homogeneous layers. The deposition of thick bands of clay along the downslope edges of fields with the gravels and sands accumulating in the rivulet channels or in deposits within the field is a good indication of this type of erosion.

Organic material in the soil can also have an affect on its behaviour as well as upon its structure. The mechanisms through which this can operate are obscure and complex although the benefits have been known for millennia. The deliberate alteration of the soil structure to improve its agricultural potential by the addition of organic material may well have been understood and practised early in history of farming communities. The extension of this understanding to the manipulation of soil for building purposes would have been but a short step. The modern perception of the addition of organic material to clays and soils is that it acts as a structural binding agent existing mainly as a framework or skeleton to hold the pot or wall together. Certainly, most organic additions do perform such a function most effectively, especially in walls as they dry out. In this case, the calcium and other elements will bind the clay and sand particles to the organic stalks whose structure will survive long enough to act as a reinforcement within the mud. The nature of this type of material can also serve to absorb some of the excess water from within the mud matrix and effectively lessen the extent of the shrinkage during drying out.

Under the prevailing conditions in Cyprus where the decay of fallen vegetal material is too rapid to allow it to be incorporated sufficiently within the soil structure and where erosion can be so severe as to prevent the build-up of a mature horizonal soil structure, the addition of vegetal matter to the soil can have one further effect. The decay of organic material can release concentrations of certain elements and minerals which would not normally be found in certain soils. Potassium and calcium are two of the primary constituents of all plants and are released during their decay. These are also two of the most important elements involved in the structural bonding of clay crystals and their inclusion within a soil can create a potentially strong and stable clay base. A soil with a fairly high hummic content, therefore, can have a stronger and more cohesive structure than those soils, like the reddish/brown soils around *Lemba*, where the organic content is low. This, however, can be achieved artificially by the deliberate addition of organic material. Wood and wood ash are composed mainly of calcium carbonates and sulphates, magnesium, iron salts and soluble carbonates of sodium and potassium, some of which are, again, important bonding agents. Grasses, on the other hand, are composed mainly of silicates (Wattez and Courty 1987, 667) and would, therefore, have little effect upon the chemical structure and bonding properties within the soil. Animal dung is also known to act initially as a plasticiser and subsequently as a binder which can inhibit the dispersion of clay in water. It is an important waterproofing agent. The mucus within dung is thought to react with lime to form a gel which supports the lime and sand until carbonation has formed a stable bond (Ashurst 1988a, 96). Other organic additions include seaweed (Karageorghis 1988, 93), vegetable oils (Denyer 1978, 93), and blood (Ashurst 1988a, 114). All of these appear to improve the quality of the clay as far as plasticity and permeability are concerned, but it is the presence of calcium and potassium which is the decisive element. Significantly, it is these elements which are most readily soluble in water and which are most prone to removal from the soil through leaching. The stability and strength which they introduce to the clays can only be maintained as long as the free passage of water through the matrix is inhibited or eliminated. Once the natural processes of saturation and drying are re-established, whether in a soil or in an earth wall, then the long term removal of the bonding agents through leaching will gradually reduce the strength and coherence of the structure.

Water, therefore, functions as an agent through which the various elements of a strong, stable clay earth bond are united and aligned to maximum effect. This can be achieved artificially as a mud wall, mud brick or baked brick structure. The more rapid and thorough the drying process the greater the bond and the longer lasting the integrity of the structure. The rapid dispersal of water through heating or air drying will leave the structure and bond of the soil substantially intact whether it exists as a natural deposit or as an earth built wall. This is the essence of mud. The reintroduction of the very medium which created the clay structure, water, will, however, also bring about its disintegration. A wall constructed in this material will only retain its integrity if protected from water. This is probably the greatest consideration in all mud construction.

2.4 Techniques of Mud Construction

Mud is a very versatile, readily available and easily used material despite its complex behaviour and inherent instability. It has been used for construction in most parts of the world from the semi-arid desert regions of the sub-equatorial countries to the alpine areas of south central Asia and the temperate regions of N Europe and America. Used mainly as a solid constructional element in the formation of walls, mud and earth are also used in some areas as a very effective and efficient roofing material. Few comprehensive or analytical studies have been carried out on mud architecture on either a regional or a local basis. The exception to this is seen in parts of Europe during the 17^{th} and 18^{th}

centuries when changes in agricultural practice included concern and investigation into various improved forms of housing (Fenton & Walker 1981, 78ff). Several areas where clays or soils were particularly suitable spearheaded the use of mud in buildings as an experiment in low-cost rural housing as well as more prestigious dwellings. France, in particular, saw a revival in this practice where even some châteaux have been constructed in mud. In Britain, the SW of England, Anglia, Cumbria and the SW of Scotland, Perthshire and Moray also experienced a revival in the tradition of mud building and produced many remarkable structures some of which still stand. The tradition of building in mud survived in these areas until fairly recently. Their innovative importance has been overtaken in America where a renewed interest in mud as a modern building material has sparked research into mud architecture on a broader basis. This interest appears to have developed in the 1960s-70s in the SW United States and in France, both areas of long standing and living traditions of building in mud. It emerged from a response to governmental and United Nations concern with ancient buildings and with the need to provide cheap, good housing in poorer parts of the World. Many of the programmes of research have, therefore, developed along the lines of investigating methods of stabilising ancient structures or of developing the most efficient methods of mud construction using modern technologies. Some of the self build manuals which have appeared in the USA tend to explore the beneficial aspects of mud architecture while conservation studies (Torraca 1988, Ashurst 1988) deal in much greater depth with the behaviour and stability of such structures. One of the best, and most systematic studies, to have emerged so far is the work of the Centre de Recherche et d'Application - Terre (CRATerre) a group of architects from France, Belgium and Peru. Their publication *Construire en Terre* (Doat *et al* 1986) produced in collaboration with other interested specialists provides an excellent synthesis and study of much of the work that has been done in the field to date. They have produced a good general basis against which more intensive specialist or site/building specific studies can develop. More recently, some studies have taken this a stage further as interest in the ethnographic aspects of mud architecture begins to reveal the wealth of information and social considerations involved. The work of Suzanne Blier (1987) amongst the Batammaliba in Togo and the Benin Republic is an exemplary instance of such developments in which she studies the role of the house within society. Kofi Agorsah (1985) working in Northern Ghana and R.J.McIntosh (1974, 1977) also highlight the need to understand buildings and the way they become part of the archaeological record before an understanding of a site can be realised.

Mud, by its very flexibility, has lent itself to a very broad range of architectural forms; not all of it orthodox. From a Western and Northern perspective these forms can, at times, be unusual verging on the improbable. Yet, this exciting range of architectural forms stresses the importance of cultural restraints upon the development of any man-made artefact and serves to warn us, as archaeologists, of the many pitfalls which lie in adopting too simplistic an approach to the interpretation of man made structures. Buildings are artefacts as much as is any pot or handaxe and, as well as their utilitarian functions of shelter and storage, they can also serve to convey information about the affiliations, status, wealth or beliefs of the individuals to whom they belong. In other words, buildings throughout human history have never been purely utilitarian creations; they have always been decorated or shaped to convey information beyond that of their primary purpose. It is this side of architecture which has always defied archaeological interpretation and has persuaded many to steer clear of it particularly when dealing with the more distant times of prehistory.

Terminology

Because the tradition of mud construction has not survived greatly in the English-speaking world there are few commonly known words in our language to describe the methods employed or to illustrate the great diversity of building types. The term "daub" is known to most archaeologists as well as to the general public through an increased awareness of our archaeological past. Less familiar are the cob buildings of the SW of England (McCann 1983) or the claywall cottages and barns which yet survive in many parts of the SW and E of Scotland in Kirkudbright, Perthshire and the Carse of Gowrie. Apart from the words used to define these buildings the majority of the words we use come from areas where these traditions are strongest; for example, "adobe" from Mexico, or the Arab words "tauf" (rammed earth) and "taub" (mud brick). These, however, like "cob" are specific to certain areas and do not generally have much currency outside their country of origin. These sorts of word will be avoided where possible.

CRATerre, using traditional French words and practices available to them, and drawing upon modern developments in the use of mud, have characterised twelve distinct uses of mud or earth in the construction of walls, thirteen if troglodyte habitations are included (Doat *et al* 1986, 11). These divisions are based upon the state of the soil when it is used, how it is prepared, and how it is applied. Earth can be used in four different ways in construction; it can be cut direct from the ground in solid lumps, it can be compacted in dry form into the desired shape, it can be compressed or moulded while still moist, or it can be poured while liquid into moulds or forms. This latter method, however, appears to be a fairly modern development and is not considered here. An examination of these different methods will illustrate the great diversity construction techniques which this material can offer.

Solid Earth Construction

In its solid form earth can be manipulated in several different ways. Excavated into cliffsides or dug into deep deposits of soil, habitation space can, in effect, be created by digging caves. This is most commonly known from the cave dwellings of NE China and the troglodyte habitations of Morocco and Tunisia. As a form of architecture it depends heavily on the natural aridity of the region and upon the inherent stability of the local soils; in both cases very fine, compacted wind blown loess deposits. The soil itself is not specifically manipulated or altered.

A second form of solid earth construction which has been more commonly used in the past is the practice of cutting turfs from established grassland areas and using these as building blocks. This is a technique more commonly found in temperate parts of the World where grasslands with a strong turf base can develop. The fortifications of the military encampments of the Romans during the first and second centuries AD in Scotland and the extensive frontier works they established between the Forth and Clyde Rivers are some of the best known examples of this type of construction in the World. More recently, the temporary sod houses of the American pioneers constructed in their push westwards across the Great Plains in the last century, and the turf houses of tenants dispossessed by agricultural and social changes in seventeenth to eighteenth century Scotland, indicate a much more widespread but little known use of this material (Fenton and Walker 1981, 9). Survivals of turf construction can sometimes still be seen in the upper gables of abandoned croft houses from the last century in parts of Caithness today. Archaeologically, walls built of this material are detected by the lines of decayed organic grasses of each turf. Certain types of structures built in this way can survive for many thousands of years.

Dry Earth Construction (Pisé)[2]

The use of earth in its dry form for construction purposes is not an immediately obvious choice of building material due to the inherent instability of unconsolidated soil. It is, however, an efficient and cost-effective process requiring less preparation than most other methods and fewer resources. Studies of more recent applications of dry earth construction (Doat *et al* 1986, 12-19) indicate that its suitability applies only to certain regions and that it has only evolved in societies exhibiting sophisticated technological development. In Europe, the earliest recorded evidence of dry earth construction is attested by Vitruvius (*De Architectura*), Varron (*Res Rustica.* 1,14,4) and Pliny (*Naturae Historiarum*, xxxv, 48-49. vii, 195) during the first century BC and AD when it was apparent that such a tradition was well established in several places around the W Mediterranean. Modern survivals are also known from areas as far removed from each other as China, Morocco, N Europe, and Peru (Doat *et al* 1986, 12). Vitruvius, in his treatise on the development of architecture, observes the use of "clods of dry earth" (glebas luteas arefactentes) amongst the indigenous peoples of S Gaul and Iberia. Pliny is much more explicit and describes a technique of construction which we now know as pisé.

"Are there not in Africa and in Spain walls of earth called (embanked walls) because they are cast in banks between partitions rather than being constructed? They last many centuries, are resistant to rain, wind and fire and they are as solid as stone." (Pliny *Nat.Hist.*, 21).

Certainly the archaeological evidence appears to support these statements despite the poor survival rate of such walls. Reports of walls from second century AD houses in the sites of *Acholla* and *Thysdrus* in modern Tunisia indicate dry earth construction (Slim 1983, 40-42). Some of the evidence does appear convincing, particularly the House of Lucius Verus and the earlier House of Silene a l'Ane

[2]The term pise has been used extensively, and probably incorrectly, in descriptions of mud structures throughout the Middle East. An understanding of its true meaning and the implications which arise from that is necessary in order to encourage more accurate usage.

both of which have quite well preserved sections of earth walling. If this technique was being used in such formal architecture by the second century AD then, may we assume earlier and more widespread antecedents in primitive and vernacular building traditions? More recent excavations at the remarkable fourth to second centuries BC Gaulish coastal town of *Martiques* near Marseille have uncovered a developed and well established tradition of urban architecture in which both mud brick and pisé feature prominently (Martiques 1988, 62). Clearly, this technique does have very ancient origins stretching well back into the last millennium BC, although, how much further back is not known. All reliable evidence so far, points to its emergence around the W Mediterranean, possibly in France, during the latter part of the European Iron Age during a period of increasing social complexity reflected in an urban setting with rectilinear buildings. This is the type of situation which can most effectively lend itself to the development of pisé construction.

"Pisé de terre" or "rammed earth" is a very specialised form of construction which makes use of earth in a relatively dry form. In those parts of the world where it is still practised the basic processes are identical and the result is a very characteristic type of wall. This is most clearly documented and described in France where the tools, methods and materials have been studied by CRATerre. The basic procedure is to compact prepared earth into consolidated blocks between two wooden shutters or forms which are held firmly in position *in situ* upon the wall being constructed. In modern constructions the wall is founded upon a stone or brick socle built for protection against water penetration from below. The walls are generally between 0.40-0.50m in thickness as this seems to be an optimum width which is both thick enough to provide a large enough mass of earth for compaction to be achieved, but not so thick as to encourage internal stresses and collapse. Sections of wall are constructed in a block of 1.50-4.20m in length and a height of between 0.70-0.90m . Wooden frames or moulds to support the wall as it is being built are set up along the inner and outer faces of the wall and are held together by wooden ties or putlogs with binding to tighten and secure the temporary structure. The dry, prepared earth is heaped into the mould and rammed firmly into a compacted mass manually in a systematic way using a weighted ram or pounder (fig. 66-71). The block is gradually built up in layers a few centimetres thick to the required height and when finished the mould is removed and set up along the next stretch of wall to be constructed. Different areas of France have evolved slightly different traditions with regards to the tools and the shuttering. In the region of Bugey (Ain), for example, the shutters are held in position by several large posts set directly into the ground. Most other regions, however, have developed a method by which the shuttering is held together by tie-logs, posts and ropes. The intersection between the various blocks is generally a distinct face which can be either vertical or oblique, the bond between them being effectively achieved by using a mud mortar.

The choice and preparation of the earth is also quite specific with different areas favouring slightly different soil types. Not all soil is suitable for use in pisé construction. CRATerre advises the most appropriate soil composition to be:

Sediment type	Percentage of total
1. Gravel	0-15
2. Sand	40-50
3. Silt	20-35
4. Clay	15-25

Table 2: Sediment percentages for pisé construction. (Doat et al 1986, 17)

In all cases the soil is sifted or sorted to remove the larger stones, gravels and all organic material and is then thoroughly mixed. At no point is water or vegetation added to the soil, and, indeed, great effort is made to exclude these materials as their presence would interfere with the effectiveness of the technique. Obviously, a totally dry soil would have no compaction properties but some moisture does exist naturally in the soil provided it is extracted at a time of year before desiccation has taken place. The significant factor in the choice of soils is the high percentage of the finer sediments, in particular, the clays and silts which together can form 35-55% of the total mass. The mechanisms by which clay forms a cohesive bond have been described earlier and, although the precise processes at work in pisé construction are not known, it is apparent that clays must play an important role. Water, when plentiful, is the key element in facilitating the clay bond but when it is present in small amounts must be assisted by other means to encourage the bond to take place. The pisé technique provides this artificially through compaction. By compressing the overall mass of the soil the clay platelets and the water are brought into closer proximity forming a weak but effective bond with the other finer elements within the soil. This structure will remain intact and stable for considerable periods of time provided it is not allowed to deteriorate through contact with water. Some of the earlier French sources describe structures which have stood for hundreds of years as usable buildings (Doat *et al* 1986, 12-13, 29). The low ratio of clay/water also means that there is almost no contraction as the wall dries out, considerably reducing the internal stresses experienced by the wall and lessening its chances of structural failure.

As a piece of archaeology or architectural detail the technique of pisé construction produces very distinctive remains and deposits. In an upstanding wall the structure is very clear revealing good detail of its origins. Each block is clearly defined and usually outlined by the mud mortar between each join. In addition, the blocked holes formed by the ties to hold the shuttering in place are very much in evidence. Under the system of construction described for the Bugey region in France, substantial postholes on either side of the wall would also be detectable. The act of compaction, no matter how thorough, cannot produce a uniform density throughout the thickness of each layer in the block. A section through such a block will reveal that the greatest compaction of the clays occurs nearest the surface of each rise grading down to the next layer.[3] This characteristic banding can also be seen in an exposed pisé wall face. The banding, the complete absence of any form of organic material, and the compactness of the fabric are the hallmarks of pisé construction and are the only clear indicators of its presence on a site or in a building.

[3]See LEV experiment E19 in pise construction where this characteristic banding is evident.

Experimental work by CRATerre has also successfully produced a circular pisé building (Doat *et al* 1986, 74). In this case the structure appears to have been quite large, probably 8.0-10.0m diameter with walls 0.40-0.50m thick.[4] The shuttering was a variant on that used for rectilinear construction using, instead, vertical planking and a segmented framework which could be pegged into various arcs depending upon the size of the structure. The importance of good, solid shuttering cannot be overstated. Experiments at *Lemba* have shown that even a primitive form of wooden shuttering can have problems and will not always produce a satisfactory result.[5] It is a technique which lends itself most effectively to rectilinear architecture. The work of the CRATerre group has demonstrated that with proper technical knowledge and skills this can be applied to circular buildings. Whether or not it can also be applied to prehistoric buildings is debatable. On balance, it can only be assessed on the evidence of the structure of the walls themselves, and this is, on the whole, lacking.

Mud Construction

Around the World this is the most common way in which earth is used in construction. As its name suggests, the critical difference between these methods and previously discussed construction techniques is the inclusion of water to form the mud. Mud is probably the most flexible and manageable method of using earth lending itself to a variety of forms and shapes. It can be used, in this form, in three ways: 1) as daub or render applied to a wooden framework (wattle and daub, kebber and mot, caber and daub); 2) as a mud wall fashioned directly *in situ* (mudwall, cob, claywall and bauge); and 3) as mud brick (adobe). CRATerre suggests further distinctions within these traditions but these reflect localised practices rather than differences of kind. Of the three, mud brick is the most widespread and, as a result, has attracted the greatest interest in recent years being the subject of most studies. This should not detract from the enduring and respected traditions associated with the other two methods both of which have very ancient antecedents.

Daub, as a technique, is familiar to many archaeologists working in most temperate regions. In its crudest form it is a fairly plastic mud with a high concentration of clay which is smeared or spread onto a framework of branches, twigs, or withies which have been bent or shaped into the required form. The mud huts of the Masai and Dinka tribes of E Africa in which a clay and dung mixture is spread over an, apparently, flimsy framework to form a structure illustrates this type of construction and demonstrates its effectiveness as a housing type in societies with transient settlement requirements (Andersen 1977, 169ff). Most of the great timber houses of the N European Neolithic and Iron Ages have strong evidence for the use of wattle and daub (Audouze and Büchsenschütz, 1989). Its development during the European Middle Ages to form panels supported within a timber framed building carried this practice to its most evolved form. This can still be seen in many of the great

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[4]No exact measurements were given. These estimates are taken from a photograph in the brief report on the project. (Doat et al 1986)

[5]See LEV experiment E19 and discussion of the results.

surviving medieval buildings and, in a more vernacular form, in the recent cottages and barns which are still in use in our countryside (Fenton and Walker 1981, 84-5).

Unfortunately, evidence for the use of daub on most sites is very poor owing to the nature of the materials used. Concentrations or spreads of a very pure clay at the base of walls in a timber structure are an important clue. Occasionally, circumstances of preservation protect fragments of the material in a consolidated form with impressions of the wattle still intact. Recent experimental work at *Butser*, however, has demonstrated how even the sudden destruction of a building by fire can remove almost all evidence of the building itself and does not necessarily result in the baking of the mud or clay daub to form a more robust vitrified material (P. Reynolds, 1992 public lecture). The way in which this material has been used dictates certain aspects of its structure. Clay of a very fine and pure nature is generally selected in order to give a smooth, regular finish and to provide the type of surface structure which will readily shed water and seal against its penetration. The behaviour of clay, as outlined above, means that even on a steep slope like a wall the clay particles do expand and re-align themselves along the direction of water flow forming an impenetrable barrier in the short term. Analysis of the soils used, however, indicate that clay may not necessarily be the main component of the material despite its importance. Medium to fine grained soil with roughly equal proportions of sand:silt and a small amount of clay (<10%) were identified in S English daub (Ashurst 1988, 117).[6] Natural deposits of this type of clay do occur but it can also be obtained artificially by sorting and sieving. The appearance in deposits on site of a material of this type of purity is a fairly good indication that clay daub has been employed. Straw or some other material is also used both as an active binder for the material on the wall and as a chemical bonding agent in its decayed form. Thin layers of clay with high concentrations of organic temper with on one surface the preserved impressions of reeds or sticks and on the other thinly laminated layers of sorted clays, is a clear indication of the use of some sort of clay daub or wall finish.

<u>Mudwall</u> is one of the least known methods of wall construction. It is present in many parts of the world and is frequently confused with pisé construction. The two are very different and can be readily distinguished. The characteristic feature of mudwall is that it is a monolithic construction which has been fashioned in mud directly in position on the wall. As a mud, quantities of water are used in its manufacture making it necessary to take precautions against the shrinkage and cracking of the clays in the wall as it dries out. These two aspects, its *in situ* construction and its behaviour while drying determine the method by which it is carried out. It is extremely difficult to identify once such a wall has been exposed to erosion which may explain its apparent absence in the archaeological record.

The materials from which mudwall is constructed vary considerably from region to region and through time. Obviously, clay is an important element in providing the cohesion and stability of the structure although it is a material which has to be used with considerable care. Like the main bonding agent in cement, clay works most effectively when combined with other coarser elements to

[6] These proportions of clay:silt:sand are very similar to the reddish brown soils of the Lemba area after removal of the coarser elements when preparing to make a render.

form the bulk of the fabric. The addition or inclusion of sand or gravels in the preparation and sorting of the soil is a common feature of the initial stages of mudwall construction. These act as an inert filler and reduce contraction upon drying in order to avoid cracking of the wall. In recent years cob buildings in the SW of England were constructed in good quality clay which formed 70% of the bulk of the fabric with the other 30% being taken up with chalk and road grit (McMann 1983, 3). Similar high proportions of clay were also recorded in the N and E of Scotland where such buildings were referred to as "clay built" or "built in claywall" (Fenton & Walker 1981, 76ff). These, however, are the products of building developments in the eighteenth and nineteenth centuries when more refined techniques were employed. Experience has shown that much lower concentrations of clay (less than 20%) are equally suitable especially when a natural calcium carbonate bond can also be achieved within the soil.[7] Sedimentation analysis of samples from mudwall (locally "clay lump") houses in southern England also support this.

Particle type	Sample 1	Sample 2	Sample 3	Sample 4
clay	5-10%	15%	10%	10%
silt	30-35%	35%	25%	25%
fine sand	30%	15%	25%	35%
coarse sand	30%	35%	35%	30%

Table 3: Sedimentation analysis of clay lump samples from 1) Little Shelford, 2) Great Hockham, 3) Hoxne, 4) Little Shelford. The coarse sand fraction includes aggregate chalk of 2-5mm size. (Ashurst 1988, 95).

Other crucial materials included within the mudwall fabric are, of course, water and an organic binding agent, usually straw. This latter element survives in an identifiable state in mudwall for a considerable number of years but undergoes a continuous and complete process of deterioration leaving, eventually, only the impression of the organic material preserved in the clay structures within the mud. Once the mud has been subject to erosion and the clay structures themselves begin to break down the soil reverts to its original state and is no longer identifiable as a mud structure. A building constructed in this material can only be recognisable in an archaeological context if the walls and floor undergo rapid burial soon after abandonment, effectively slowing down the processes of internal structural disintegration.

The methods of construction in mudwall are in fact dictated by the limitations of mud itself. It cannot be constructed to any great height in one episode for fear of collapse and it must undergo a period of drying out between each construction episode or "rise". The mud is generally prepared in advance of the construction although experience has again shown that an adequate material can be created without too much forward preparation.[8] Most authorities, however, stress the need to prepare the soil well before construction is to take place in order to provide a high quality material. In northern areas the clay can sometimes be broken down and mixed or trodden many months in advance. Digging

[7] See LEV experiment E4 in which soil of a fairly low clay content was used effectively in mudwall construction. The anthropogenic soil used is analysed in section 2.1 above.

[8] See LEV experiment RH1, RH3-5 in which the mud was excavated and prepared the day before use.

for the clay in winter to allow the frosts to break it down is recommended with the mixing of the soil with water and straw taking place in early March followed by construction over Spring and Summer (McCann 1983, 10). Short straw generally seems to be the favoured organic binding agent although records also exist of other materials being used. In cases, the mud is mixed with the straw several months before use and again immediately prior to construction. These fibrous materials improve the tensile strength of the mud. Other materials such as blood, oils, and dung can also be included at this early stage in order to improve the quality of the mud mix. It is thought that the decay of these materials within the mud over the months prior to construction creates a gel which can improve the plasticity, impermeability or bonding capabilities of the final mud mix. The mucous in dung reacts with lime in the soil to form this gel which reacts in two ways by supporting the lime and sand until a suitable bond has been achieved and by stabilising the clay mineral wafers (Torraca 1988, 101).

The wall is built in stages upon a foundation of stone which serves to raise the mud above the effects of rising groundwater and splashback from rainfall (fig. 66, 106-7). This foundation can be no more than a couple of courses high although local considerations can dictate otherwise. The thickness of the walls usually ranges from 0.45-0.60m and up to 1.0m although the lower range forms the most stable type of structure. Thicker walls have more scope for developing internal stress factors which could ultimately lead to structural weaknesses. Thinner walls are known, for example, in parts of W Africa (Blier 1987), which can be perfectly adequate when applied to lightly roofed single storey structures or compound enclosures. Mud is heaped onto the foundation and manually trodden or handled into position to a height of 0.10-0.60m. Anything higher could not be supported while the mud is in a wet condition (fig. 84). Drying takes anything from one day to one week depending on local weather conditions and is essential in order to prevent cracks developing for the entire height of the wall and to provide a firm platform for the next layer to be added. This continues until the desired height has been achieved with windows and doors being created during construction or cut through the final wall after it is finished and has been allowed to dry out thoroughly. This basic method is applied in almost all parts of the world where mudwall is used. Modern tools and equipment can create a more regular and straighter type of wall but judgement by eye and hand finishing does also produce an effective long lasting wall. The differences are probably more aesthetic rather than practical.

Identification of this material is fraught with difficulties. It is apparent that the soil components of the wall very frequently reflects local soil conditions which can make the two quite difficult to distinguish. It is usually only the internal structure of the material which identifies it as a man-made substance. The structuring of the clays around the various inert fillers and the organic binder in the wall is an obvious clue, although, when reduced to broken lumps, may be difficult to distinguish from a rough plaster or badly eroded mud brick. Smoothing of the wall face by float or by hand has the effect of bringing to the surface finer clay particles which are orientated in lamina parallel to the outer surface. When preserved this may also be used to indicate the original nature of the structure. Frequently, though, very little of such a wall will survive if left unattended for any great length of time. Its identification is a matter of very careful detective work and no small measure of luck.

Mud brick has been used for many thousands of years and has been recorded in many parts of the World. In the Middle East it evolved as a method of using this building material very early in the transition towards a sedentary life style. The shape and size of the mud bricks has varied greatly and is often taken as hallmark of cultural links, for example, the hog-back mud bricks of the PPN in the Levant or the practice of leaving finger impressions on the upper surfaces. The size of the bricks has also played an important part in trying to understand related building practices but this is increasingly being viewed as a locally controlled variable. All early occurrences of the mud brick are in an unbaked hand-made form with the moulded and baked types arriving in the later prehistoric periods during a time of increasing and widespread cultural and social complexity.

The development of the mud brick has probably created one of the most efficient methods of the use of mud in the construction process. It avoids the difficulties of shrinkage and cracking which create so many problems in monolithic mud construction, it means that a large part of the construction process can actually take place away from the construction site but close to the source of water and soil, building work can take place continuously without long drying periods, and it does not require high quality material. This has obvious benefits both in the amount of labour involved and in the consumption of certain scare resources, particularly water. The strength of a mud brick does not rely solely on the behaviour of large concentrations of clay but rather on the internal cohesion and lack of major stresses in its small size. Clay obviously does play an important role in holding the brick together, as it does in all soils, but the scale of the brick means that it works more efficiently if coarser materials like sand and gravels are included as well as straw or organic binding agents. In this case the clay acts as the cement to hold these elements together rather than as the main structural material. An examination of any sun dried mud brick will reveal considerable quantities of straw binder and a high proportion of coarser grit, gravels and even small pebbles. These do not impede the effectiveness or strength of the brick.

The identification and excavation of mud brick can be notoriously difficult often requiring years of experience and a good understanding of local conditions before it can be achieved with confidence. In parts of the Middle East this difficulty was recognised and left to local workmen trained in its detection and with far greater experience and skill than most European archaeologists. This problem is most acute in the early prehistoric periods in which sun dried and irregularly shaped bricks were being used. It is not difficult to understand why this should be such a problem. Because the material used in the making of mud bricks need not be of such high quality it was frequently derived from deposits close to the site of construction frequently incorporating earlier archaeological material. The mud which was used to bond the bricks together would also have come from the same source providing very little differentiation between the two. Frequently, the only method of identifying a wall of mud bricks and mortar was in the structure of the bricks themselves and in the type of organic bonding agent employed. It has been described above how clay behaves when mixed with small amounts of water and the sort of internal structures which would develop have been described. The alignment of the clay crystals to form compact laminated bodies occurs both along the outer face of the mud structure and internally around larger, coarser grained elements. It is these structures which, in the absence of a colour difference, give the most distinctive visual clue as to the presence of a man-made unbaked mud artefact. This structure can only survive intact if it is protected from all other forms of erosion or soil formation. Unfortunately, this is never the case. Observations at excavations of an eroding mud brick structure at *Souskiou* Village[9] have demonstrated how, even when the type of structure is known, the effects of various erosion processes, particularly rain water, can quickly break down the internal structure of the mud brick and obscure any distinction between it, the mud mortar and the surrounding deposits (fig. 59). Only the rapid burial of the bricks and wall can delay this process (fig. 52). However, even under conditions of burial water penetration through leaching and groundwater fluctuations can have a devastating long term impact on the integrity of the structure of the mud brick by gradually breaking down the clay structure in much the same way as happens on the surface. Obviously, local environmental conditions are crucial in determining the rate of decay of clay structures preserved in its soil. But, it is not surprising that poorly made bricks can be difficult to detect. It may be that the higher the clay content and the harder the firing the longer it will take for the processes of erosion and soil formation to destroy the brick. It does not hold out much hope for very early and very primitive forms of mud brick construction.

2.5 Plasters and Renders.

Plasters and renders will be dealt with separately for a number of reasons. It is quite apparent when reading the archaeological literature that there is considerable confusion about the meaning and nature of these materials. This confusion does have important implications for an understanding of the development of some very significant technologies within the Middle East. The achievement of lime plaster making itself has lead to some speculation about its impact upon the environment at the time and upon important social and cultural developments within prehistoric Middle Eastern society. There is also the suspicion that the emergence of such a technology was a precursor to the development of ceramic industries and ultimately to the early use of metals in prehistory. All of these technologies, plaster making, ceramics and metal working spring from a common pyrotechnic basis involving the chemical and structural alteration of naturally occurring materials. They are all part of the same tradition. From this point of view, the development of the earliest of these, plaster making, is of particular interest. Yet, it is the sad case that very little thorough work has been done in this area apart from a few notable exceptions (Gourdin *et al* 1975: Kingery *et al* 1988). It is, however, frequently impossible to recover information from early sites where an understanding of the different types of plaster has not been demonstrated in publication. The terminologies adopted by many excavators in

[9] See the excavation of House 162/1 Trench 3 where this process was observed in action.

their reports on these sites must, unfortunately, be disregarded and the information considered at the very least, suspect.

The use of mud or clay as a plaster and the production of true lime and gypsum plasters are two very different technologies. They both ultimately serve the same functions of protecting vulnerable building elements, providing durable floor surfaces and enabling more elaborate architectural detailing to be executed. It is also apparent that the two technologies existed side by side within the same cultures making a clear division between the two on cultural grounds unreliable. It is important to understand the nature of these materials before the significance of this difference can be appreciated.

Renders and Mud Floors

Renders are preparations of mud or clay which are used for coating wall surfaces as a sacrificial layer designed to protect the wall at the expense of the render itself. It is, in general, an annually renewed surface, although experience has shown that the renewal of this layer on a building need not be total and may be postponed under milder winter conditions.[10] The prime function of the render is to prevent water penetration into the vulnerable wall structure which would rapidly disintegrate if this were allowed to happen. Despite its transient existence, greater care appears to have been taken with the preparation of the render than with the wall itself. A reflection upon the difference in function between the two features provides the clue for this apparent incongruity. The wall is a structural load bearing element which is subject to considerable compressive forces and, as such, must be designed to respond to such a function. Long term structural stability and flexibility are the primary considerations of any material used in wall construction which is readily provided by soils with a fairly low ratio of clay: coarser sands and gravels. A render, on the other hand, is designed for short term high resistance to water penetration and erosion. As such, a much higher ratio of clay with far fewer coarse elements and the addition of materials to improve its water rejecting and cohesive properties is essential.

The type of soils used for the production of a render varies form region to region. They all have in common a fairly high clay content in the order of 10-30%. In the Paphos area of Cyprus local tradition favours the use of the reddish/brown soils which overlie the kafkalla or the eroded upper terrace slopes. This has a total clay content, in the *Lemba* area, of 9-10%. With the removal of all coarser grits this brings the clay percentage up to 15-17%. The presence of local havara with a clay content of 30% readily available indicates that a deliberate choice based on experience has been made to restrict the total amount of clay within the material. Higher amounts may be unnecessary or undesirable. An initial sorting and grading of the reddish/brown soil is essential in order to exclude coarser gravels and pebbles which would result in a poorer material which would not provide a suitably smooth surface. A common practice, and one which is heavily stressed by older practitioners

[10] See LEV RH1-5 in which regimes of repair and maintenance of mud buildings demonstrates the varying needs of wall surfaces according to differing local conditions.

of the art of render-making, is the need to incorporate an organic element and to work the material continuously over four to eight weeks, longer if time permits. Finely chopped straw is probably the most commonly used material although others are also considered, their use being dictated by local conditions. The long period of maturing and working serves to break down the soil and to allow total hydration and aeration of the mix resulting in the partial decay of the organic additive and the complete restructuring of the clay platelets. Under conditions of long term maturing the decay is total and the natural organic nutrients and elements are released into the mixture bonding with the clay and providing the increased cohesion and water-proofing necessary to make a good quality render. It frequently has the texture and aromatic aura of a very mature dung heap. The evil smelling mixture is then applied to the wall of the building in much the same fashion as modern plastering although in primitive conditions it was usually applied directly by hand (fig. 112). This was applied to a dampened wall and was usually no more than a few centimetres thick as any greater application would separate from the wall and collapse under its own weight. Smoothing or burnishing by hand or with the use of an appropriate tool was then carried out and served to even out the layer and to raise the finer clay particles to the surface which would then become orientated parallel to the surface in thin lamina. It also pushed the clay into the many micro-cracks in the wall forming a greater bond with it. The effect of this would be to provide an immediate and well structured barrier to the exterior of the wall which, under limited to moderate weather conditions would quickly seal against water penetration and present a smooth surface encouraging water run-off. Heavier and more persistent rainfall would, however, lead to the dissolution of the clays and the gradual erosion of the render (fig. 122).

Renders created in this way should be readily identifiable in the archaeological record unless they are of a very poor quality, in which case, it may be impossible. However, the high clay content, the finely structured lamina in a well sorted and aerated matrix with fine and partially decayed organic material is a good indication. The presence of an exterior surface, particularly if burnishing or some other form of treatment has been applied, will add further weight to any assessment.

Floors were also frequently prepared in a mud base. There is a distinction to be made between specially prepared floors and those which are the result of daily use and most commonly referred to in the archaeological literature as "trampled" earth floors. There is a suspicion that the term "beaten earth floor" is also used interchangeably with "trampled earth floor" although the two are very different. The former is created by laying specially prepared earth or mud and beating it with clubs or pounders while it is drying, the latter is compaction through normal surface wear and requires no special preparation. The mud for the specially laid floors is prepared in much the same way as that for renders with the addition of materials like charcoal, ash or dung (Denyer 1978, 94). If a good quality clay was chosen and spread with a low moisture content the resulting floor could be hard and durable with very little cracking or damage after a suitable working while still moist.

The internal formation of these floors would be of well mixed, aerated material of finer sediments with obvious clay structures and possible surface laminations surviving in areas. Organic material would also be present and there would be some indication of surface compaction depending on the period of use of the floor. Obviously, such a floor could be confused with a trampled earth floor which has been founded upon the remains building material from the construction of a mudwall building. In this case, an assessment of the degree of distinction from underlying deposits must be made and a subjective, though cautious, opinion formed.

One area of potential confusion in dealing with mud plasters and floors is the practice of adding amounts of lime which can act as a stabiliser and strengthening agent. Lime, in this case, can be no more than finely pulverised limestone dust which has not been subject to any other industrial process but which is identical to disintegrated lime mortar. Instances of the use of lime in this way have been recorded at *Jericho* and *Ganj Dareh* where a mixture of clay and fine, irregular, fractured lime particles produced very strong, stable mud bricks (Kingery *et al* 1988, 226). A similar practice was also identified at *Khirokitia* where the mud bricks were made of a material with a very high (42-60%) calcium carbonate content (le Brun *et al* 1984, 31). The inclusion of this sort of material within plasters of mud would produce a similar result and may create wall facings and flooring which, upon superficial visual and tactile assessment alone, could give the impression of true lime plaster. A much more rigorous consideration should always be afforded such plasters.

Lime and Gypsum Plaster.

Lime and gypsum plasters are made from limestone and gypsum respectively. They are both structured in the same way as their parent materials and have the same strengths and weaknesses. A good plaster will, chemically and in its crystalline composition, be indistinguishable from the parent material and may only be identifiable as an artificial product by its context and the complete lack of any micro-fossils. In practice, however, it is rare to find a completely pure plaster as it is frequently mixed with marly clays and aggregate formed from the partially calcined, broken fragments of limestone or gypsum. The process of making these plasters requires an advanced knowledge of how materials can be altered through industrial activity in a way which cannot be deduced from purely natural phenomena. Its appearance by 12,500 BC in the Middle East is a remarkable achievement.

Lime plaster is the more complex, but also the more durable of the two. Its production requires a very specific and controlled cycle of activity. Pure limestone is the preferred base material although experiments have demonstrated that derived limestone deposits, such as kafkalla, are equally suitable.[11] Limestone, which is almost pure calcium carbonate ($CaCO_3$), is first burnt in a kiln with temperatures sufficiently high (800-900^oC) to drive off all the carbon dioxide (CO_2) leaving only calcium oxide (CaO) or quicklime as it is more commonly known. The calcination process must be maintained for several hours at this temperature in order to be successful (fig. 72-3). The quicklime is slaked in water (H_2O) over several days or weeks to allow carbonation to take place producing calcium hydroxide ($Ca(OH)_2$) or slaked lime. This is a reactive and, potentially, explosive process in which a chemical bond takes place releasing heat and creating a new stage in the material. It is in an inherently

[11] See LEV experiments E15 in which lime plaster was successfully made from kafkalla.

unstable state and must be kept under water protected from carbon dioxide in order to allow complete carbonation to take place. The slaked lime paste can be stored in this manner for some considerable period of time before use. At the end of this process the slaked lime is in the form of a paste which can be mixed with an aggregate and spread or applied like a plaster or cement (fig. 74, 76-80). The exposure of the slaked lime paste to the air allows contact with carbon dioxide (CO_2), the element removed during the initial burning process, which is then recombined with the calcium hydroxide ($Ca(OH)_2$) to form calcium carbonate ($CaCO_3$). At this stage the water is expelled from the matrix during the chemical reaction leaving only the calcium carbonate (Ashurst 1988, 1-4). It has now returned to its original form but has, in the interim, been exploited and reshaped into a man-made artefact. Pure lime plaster, however, is still quite porous and does not have any great strength. The addition of an aggregate material to the slaked lime paste serves to increase the bulk of the matrix and to stabilise it into a more uniformly coherent mass. There is no shrinking of the material during the final carbonation or setting of the plaster as it achieves hardness through chemical carbonation with the air and not through drying out as is the case with clays.

When applied to walls and floors, therefore, it forms a very strong and durable surface. Smoothing out or floating of the plaster serves to raise the finer and purest elements to the surface where it can form a very smooth, polished, insoluble finish. The coarser aggregate elements are concealed beneath this surface and, in section, there is an obvious gradation of the elements from coarse aggregates bonded with lime mortar through to a fine surface layer of pure lime plaster. Under microscopic examination the distinctive microstructure of lime plaster consisting of microscopic spherical particles can be seen (Kingery *et al* 1988, 221). This is clearly different from the parent material and is one of the characteristic features of lime plaster. On a macroscopic scale, the absence of clay laminations, its hardness, the density and whiteness of the matrix and the complete absence of any organic material are other identifying features such as micro-fossils.

Gypsum plaster is created in much the same way as lime plaster although it is a slightly less complicated process. The final result, in this case, is not as hard as lime plaster and is much more susceptible to water absorption. It is quite likely to dissolve and break down if exposed to water penetration.

Gypsum is made by heating alabaster or gypsum rock ($CaSO_4.2H_2O$) at temperatures of 150-400°C to form a hemihydrate ($CaSo_4 \cdot {}^1/_2H_2O$). This is a dry pulverised powder which, when mixed with water, reacts to form a dihydrate ($CaSO_4 \cdot 2H_2O$); the original form of the material. This can be applied to a surface or shaped to form an artefact or feature. It is more commonly known as plaster of Paris. This material has the same chemical composition as the parent material but can be identified by its distinctive microstructure consisting of a "... forest of well-formed microscopic interlocking needle-like crystals that cause the rehydrated reaction product to cohere." (Kingery *et al* 1988, 221). Gypsum is applied in much the same way as lime plaster and is used for very similar purposes. It is softer and more porous giving it a powdery feel which is not evident in a well preserved lime plaster. It is important to describe gypsum plaster in order to stress its differences from lime plaster. Cyprus is an area in which both source materials appear yet, in early prehistory, there is no evidence of gypsum plaster production.

2.6 Summary

The ability of archaeologists to identify and assess the different types of materials encountered on a site is crucial to an understanding of how that site was formed and of how ancient Man used or interacted with the environment. An attempt is being made here to help with that process by providing clearer methods of visual identification which can be linked in with the context of the materials as well as local conditions.

It has been shown how soils develop in an area like that around *Lemba* and how this is controlled by the local climate and geology. The properties of these soils are quite specific and influence the way in which ancient Man used them in house building. In particular, the behaviour of clay is highlighted as a primary element in creating stable and strong structures which were exploited in prehistory to create walls and other constructional features. The important role of calcium carbonate, which is present in all the soils in the area, is also indicated. Various techniques of building in mud are discussed on a broader basis demonstrating how the processes are carried out and stressing the need for careful and considered application of the various terms. It is concluded that pisé construction was unknown in prehistory and was unsuited to building methods at the time. Mudwall, mudbrick or stonewall (clay and stone) are more likely to have been employed. The identifying characteristics of each building method are discussed with the hope that a more informed assessment in the field of mud construction will, in the future, be possible. These characteristics will be used in the following chapter for identifying building materials. In particular, the relative proportions of the various grain sizes are highlighted as being an important of whether, or how, the soil was selected for construction. Coarser elements are generally excluded, even in wall building, and there is a balance between sand, silt and clay with the latter <20% of the total bulk of any sample with sand and silt comprising c30% each. These sorts of proportions may give an indication that the material has been deliberately sorted and is not in its natural state. The internal structure of material being examined is also important. Mixing of muds creates voids or tiny air pockets which survive and indicate an artificial origin. The mixing also encourages the formation of clay structures which either form bridges or laminations within the material and form, further, identifiable features. The presence of organic material, which would have acted to bind the mud and increase its waterproof and cohesive properties is discussed. Although it is rare for the organic material itself to survive, the rapid setting of the mud would preserve the impression of the organic within the clay structures. This also is a clear indication of an artificially created material.

The various types of plaster; mud, lime and gypsum are also covered with an indication of the importance of these technologies for understanding later developments within the Middle East. Again a plea is made for care in assessing the different types of plaster and for following a more rigorous form of investigation. The manipulation of clays to form a suitable material for wall finishes and floors is described and it was concluded that havara, although containing a high clay content, would not be used in its purest form which would be prone to shrinkage and cracking but would probably be mixed with coarser sands and organic material to act as a stabiliser and binder. The method of applying clay as a plaster produces very clear structural orientation in the material which is readily identifiable and a good indicator of its artificial origins. Floors are also described and a distinction made between those floors which have been deliberately created from a coarse type of mud plaster and those which are the result of frequent or heavy traffic. The manufacure of lime and gypsum plaster has also been described in order to stress their chemical origins. It is concluded that only lime plaster was manufactured in prehistoric Cyprus and that it is not a soil, unlike other material discussed. This is a chemically altered stone whose structure on a site will bear evidence to its manufacture and will contain no indications of a soil based material like sediment variation, clay structures or organics. There should be no excuse for confusing clay and lime plaster if a sufficiently informed observation is made.

The conclusions reached in this section will be used as a basis for identifying, assessing and describing materials and elements from the excavations at *Kissonerga* and *Mytlouthkia* (chapter 3) and from the observations and excavations at *Souskiou* (appendix 2) and the LEV (chapter 4).

Chapter 3: The Archaeological Material

The past is a foreign land and I no longer live there.
Duka, Hamar Trilogy, BBC.

In the previous chapter the methods and characteristics by which excavated building materials can be identified have been described. The archaeological material can now be examined with a classification of all building elements found on Chalcolithic sites and then relating these elements to identifications of the various materials used. In the first instance, however, it will be necessary to review the course of archaeological excavation on the island and to indicate the major sites which will be included in the following discussions. In all the discussion below the chronological scheme of periods is that developed for the site of *Kissonerga*. These are as follows:

	Kissonerga period	*Erimi* levels	*Mylouthkia*	*Lemba* period
Neolithic	1			
Early Chalcolithic	2		B200, B152, pits	
Middle Chalco	3a	I-VI	?	1
	3b	VII-XIII		2
Late Chalcolithic	4			3
Early Bronze	5			

Table 4: Correlation of periods and levels between the main Chalcolithic sites. The Lemba periods are those devised for the LAP 1 publication of the site (Peltenburg 1985a).

3.1 The Sites of the Erimi Culture.

History of Excavation

Thirteen sites of the Erimi Culture have been excavated on the island of Cyprus, seven of which have produced upstanding architecture and have a relevance to the present study. The majority of the larger excavations have been explored within the last fifteen years but the site of *Erimi* Pamboules itself was excavated in 1933-35 by P.Dikaios in his role as the Director of Antiquities of Cyprus (Dikaios, 1936). An examination and reassessment of this site by Bolger in 1988 has equated it convincingly with periods 2-3, EChal-MChal, within the dating framework established for the Lemba cluster of sites (Peltenburg 1991b). Dikaios was also responsible for excavating the site of *Kythrea* to the E of Nicosia in 1930, (Gjerstadt *et al* 1934). Although badly eroded this site did produce five buildings in varying degrees of preservation one of which, Hut III, was largely intact at foundation level. This building with its stone built foundation wall, earth floor, central hearth (post support in Dikaios terminology), and segmented compartments equates very well with structures from the upper levels at *Erimi*. The pottery, which includes RW vessels, and the presence of picrolite cruciform figurines from the deposits indicate a period 3, MChal, date for the site. *Lapithos* Alonia ton Plakon (Gjerstadt 1932) and *Ambelikou* Ayios Georghis (Dikaios *et al* 1953) are two smaller sites excavated by Dikaios which produced limited architectural evidence. In 1947 Dikaios moved his activities to the area around Kalavassos near Larnaca where he investigated two sites at *Kokkinoyia* (Site A) and *Pamboules* (Site B) which proved to be heavily eroded period 2 , EChal, settlements with pits, some possible tombs and occupation evidence set in hollows with postholes around the edges of the hollows. This is a characteristic EChal arrangement which has been confirmed by similar discoveries at *Mylouthkia*, *Kissonerga* and *Ayious* (see below).

In the period between 1950 and 1976 excavation in the prehistoric period in Cyprus concentrated on investigations within the LNeol. (Sotira Culture) period. During those explorations evidence of post-Neolithic occupation was detected at the sites of *Philia* Drakos A which was excavated by T.Watkins (Karageorghis 1970) and at Ayios Epiktitos *Vrysi* (Peltenburg 1982a). At the former site underground interconnected pit complexes similar to those later found at *Ayious* were uncovered. These all date to the EChal, period 2, phase of transition from the Neolithic.

Erimi stood as the "type site" for the period and has provided most of what was known about the Erimi Culture until the establishment of the Lemba Archaeological Project in 1976 and the initiation of a long term programme of study directed specifically at the Chalcolithic Period in Cyprus (Peltenburg, 1979). Excavations were undertaken on the sites of *Lemba* Lakkous, Kissonerga *Mylouthkia* and *Kissonerga* Mosphilia by Prof. E.Peltenburg between 1976 and 1993 (Peltenburg, *LAP* 1, *LAP* 2.1-2). As an exercise in cross-project co-operation I, as a member of the LAP team, was also invited by the Director of Antiquities, Prof. V.Karageorghis, to excavate at his LBA site of *Maa* Palaeokastro where some EChal material had been found (Thomas, 1988). More recently, I have been able to carry out further excavations at Kissonerga *Mylouthkia* where good, upstanding *in situ* EChal material was found for the first time (appendix 3). Much of the material from these various excavations is in the process of preparation for publication and will appear within the next few years.

One other team on the island, The Vasilikos Valley Project, under the direction of Dr. I.Todd, was also established in 1976 and embarked on a programme of exploring in depth the history and development of human settlement and culture in the valley. It was responsible for the excavation of an EChal site at Kalavassos *Ayious* with its enigmatic series of underground pit complexes (Todd 1991) The publication of this site is also underway but it has produced no upstanding remains and so has been largely excluded from the present study.

The chronology of the Chalcolithic Period was first established by Dikaios through his excavations at *Erimi*. This was initially done without the aid of C^{14} dates which led Dikaios to conclude that the early levels at *Erimi* followed on immediately from the LNeo Sotira Culture typified by his excavations at *Sotira* Teppes itself. The later dating of three samples saved from the upper levels at *Erimi* forced Dikaios to revise his chronology for the site and to establish a longer separation between the two periods (Dikaios 1962). The work of the LAP with the publication of *Lemba* in 1985 set a more reliable framework. This has been progressively refined with the publication of further numbers of radio-carbon dates and with the increasing subtlety with which phases can be detected through stratigraphic analysis, pottery seriation, artefact classifications and palaeoenvironmental changes. The final five phase sequence which has been established for *Kissonerga* will be followed in any succeeding discussion of the archaeological material (*LAP* 2.1, forthcoming).

Erimi Pamboules

Erimi lies some 50km E of the main cluster of excavated Chalcolithic sites and, as such, could be expected to exhibit some regional or local differences in both its cultural repertoire and architectural traditions. This is not necessarily the case. In her reassessment of Dikaios' excavations Bolger sees a marked shift from preceding periods towards a greater degree of conformity during the EChal in particular (Bolger 1988, 127). This is also true for the architectural and building evidence despite the difficulty of recovering such information from published material alone. Dikaios excavated the site in arbitrary spits which he later divided into thirteen levels. On the basis of architectural differences he grouped these levels into three divisions or phases; phase 1 (levels I-IV), phase 2 (levels V and V/VI) and phase 3 (levels VI-XIII). A further division into two periods for the whole site splits phase 3 with period 1 being levels I-IX and period 2 being levels X-XIII. This is an awkward solution and it is more likely that the division based on the observed architectural changes is the most reliable.

Phase 1 (levels I-IV) are characterised by broad shallow hollows in which traces of "beaten earth" floors have been found. Scatters of stones around the hollows and occasional postholes were taken to indicate the outlines of structures while settings in the centre of the hollow were considered to be the supports of timber posts (Dikaios 1936, 9). Considerable amounts of carbonised material lying in and around the hollows were interpreted by Dikaios as the collapsed remains of a mud and brushwood roof which had been erected, tepee style, over the occupation hollow. This was later classed, by Dikaios (1962) as his type 1 building. This concept of occupation in shallow hollows with the construction of rude, flimsy huts has been exploited on numerous occasions as evidence of some sort of traumatic event which brought about the collapse of pre-Chalcolithic society and produced a race of people who were either too demoralised or too traumatised to construct more substantial dwellings. Earthquakes and climatic deterioration are cited as possible catalysts for this sorry state.

Phase 2 (levels V-V/VI) sees little apparent development in building traditions apart from the fact that the hollows have been filled up and people must now construct their flimsy huts on level ground. Beaten earth floors with diameters of 4.0-5.0m surrounded by lateral thrusting poles are still thought to constitute the predominate architectural style (Dikaios 1936, 10-12). In one instance, an earth floor, set in a shallow scoop and surrounded by a rickle of stones was dismissed, in the absence of any postholes, as an open air hearth with a low protecting bank. Obviously, it is impossible to determine the true nature or appearance of such a structure but a comparison with buildings in Area 1 at *Lemba* is suggested and would be more in keeping with developments which are now known to have taken place. In his reassessment of the 1933-35 excavations for *SCE* IV.Ia which elaborated his classification of buildings, Dikaios classed the above ground posthole structure as a type 2 building and elevated the stone and mud bank to a type 3 building (Dikaios 1962).

Phase 3 (levels VI-XIII) saw, at *Erimi*, the emergence of a much more durable and identifiable architectural tradition. Sixteen circular buildings constructed along similar lines were uncovered stratified in several metres of deposits. These were his type 4 buildings. They were substantial structures with stone constructed lower coursers standing, in some instances, several courses high with paved and unpaved entrances, pivot stones, earth floors and plastered floors, and many basins, hearths and settings. In one instance, Hut VIa, Dikaios describes it as being an annexe opening off the adjacent larger building. It is difficult to assess this arrangement from the published information, certainly it is possible on structural grounds, but the plan is less convincing. His description of most other architectural features have strong echoes amongst structures excavated at *Lemba* and *Kissonerga*; the shallow foundation hollows, the stone wall constructions, the packing material occasionally found at the bases of walls, the entrances and some of the internal features. However, there are a few instances where his interpretation of the *Erimi* material is at odds with that from more recent excavations. His interpretation of one group of buildings, Huts VIa-VIIIa, places a ring of postholes lined with lime around the top of the stone wall base. There is no clear photographic or drawn evidence to support this and it has certainly never been detected on other sites. The verdict on this one must remain not proven. Centrally positioned plaster platforms with dished scoops on their surface were interpreted as bases for upright timber roof supports. This was a fallacy which remained in the literature until it was finally debunked with the publication of the report on the *Lemba* excavations in 1985. Dikaios was probably also responsible for reinforcing the uncritical acceptance of concepts like "beaten earth floors" , "pisé walls" and "plaster" within the literature surrounding prehistoric Cypriot buildings. It would be wrong to criticise Dikaios for his failure to be more analytical with this aspect of prehistoric architecture: after all, the framework of such studies had not then been established. However, it is still curious that such specific terms and usage had crept in to the repertoire of common archaeological vocabulary; it would have been far more obvious to have employed words like "earth" or "mud" which was the common currency of traditional Cypriot building knowledge.

Clearly, Dikaios views on the architecture of *Erimi* have greatly influenced our interpretation and understanding of Chalcolithic building practices. His prejudicial use of the term "hut" to describe the buildings sets an immediate bias which is reflected in their interpretation, particularly of the earlier structures. The reconstructions were simplistic and impractical. The type 1-2 structures of tepee-like arrangements with ring of posts set on the ground and meeting at the centre to be supported on a central post were covered with brushwood and mud. Such a flimsy dwelling would not have survived long the Cypriot winter and were probably a very inefficient use of space. Again, with Hut types 3-4 there were difficulties with the interpretation some of which are mentioned above and which could have been avoided given a more thorough understanding of traditional buildings and a more rigorous method of investigation.

The Lemba Cluster

The *Lemba* cluster of sites forms a distinct and, so far, unique, group of excavated sites covering the entire range of the various Chalcolithic periods with tantalising links into both preceding and succeeding periods. The work of the LAP has been an unsurpassed opportunity for investigating one particular period of Cypriot prehistory in depth and has provided a means of study of an archaeological culture on a broad basis both within its entire time scale and within its palaeoenvironmental setting.

The sites lie along the fertile coastal plain of the Ktima Lowlands within the boundaries of the lands of the villages of Lemba and Kissonerga. The local environment and resources have been outlined by Xenophontos (*LAP* 1, 6) in his report on the situation of *Lemba* and by Morrisson (Peltenburg *et al* 1982) for the site of *Mylouthkia.* It is apparent from these two sites, and from *Kissonerga* itself, that sources of water were a major consideration in site location; all have access either to free flowing streams and rivers or to a natural spring line. The streams running alongside *Lemba* and *Kissonerga* are, even today, good sources of clays and reeds. The underlying bedrock is a calcarenite (calareous sandstone) of the Athalassa Formation (Plio-Pleistocene) which overlies softer marls and clayey sandstones of the Mammonia Complex (Xenophontos, *supra*). These rocks have had a significant influence on building methods as their softness and availability have meant that pure stone construction was not an easily achievable goal and that mud was always considered an important element. The highly calcareous nature of the rock and the soil has also affected the way in which it can be used as well as its long term behaviour. The natural soil cover of the upper marine terrace is a poor reddish/brown soil which is being continually removed by sheet erosion while on the lower terraces a thicker, more fertile and better developed colluvium has formed. Climate, always an important consideration in building practises has probably not witnessed significant or dramatic long term changes over the millennia (*supra*, 8).

Lemba was excavated in two areas which produced material covering a broad time span, so much so that the two areas were effectively treated as two separate sites. Area 1 revealed an early period 3a, MChal, settlement organised with rows of fairly standardised buildings arranged below a slight terrace. These buildings are in contrast to the roughly contemporary structures from the upper terrace at *Kissonerga* which provide a stark reminder of the pitfalls in assessing buildings or settlement patterns from one site alone. Area 2 at *Lemba* contained the remains of period 3b buildings which were largely overlain and destroyed by a period 4, LChal, building complex which appears to represent a single homestead or farmstead, probably within a village setting. Some of the buildings from *Lemba* are unique to that site, particularly the Area 1 structures, while others provide good comparative material for excavations at *Kissonerga* and *Erimi.* It is unfortunate that very little structural material was collected from the buildings themselves as this would have extended considerably the base from which the assessment of Chalcolithic buildings is made.

Initially excavated in tandem with the work being carried out at *Lemba* from 1976-83, *Mylouthkia* produced very little apart from the heavily eroded remains of pits and hollows. Although of great value for a study of the palaeoenvironmental and artefactual residue of period 2, EChal, it was of no significance from the point of view of early buildings. A final attempt at investigating this important site in 1994, however, reversed this situation with the discovery of two intact period 2, EChal, buildings one timber constructed and the other stone and mud (appendix 3).

The most extensively excavated, and most productive site of the LAP cluster is that at *Kissonerga*. Again, this site was excavated in two areas; the lower and larger area exposing period 3a, 3b and 4 structures while the upper and smaller area revealing period 3a buildings overlying the very tantalising remains of period 2 hollows. The scale of the information and the degree of preservation of many of these buildings as well as high standards of excavation has meant that considerable information about prehistoric buildings has become available. It is largely this site which forms the basis of the consideration of Chalcolithic architecture and building practises in this study.

3.2 Structural Components of Buildings

The preservation of the archaeological remains at *Kissonerga*, and the much greater extent of the excavations there, have produced a broader base for understanding the individual structural elements of these prehistoric buildings and of the way in which the elements were assembled to create a building. As a result , the scheme developed for the publication of *Lemba* (*LAP* 1, 1985) must be substantially revised and, although care has been taken to ensure correlation with the old *Lemba* system where possible, differences do occur and are indicated for the sake of clarity and comparability. Lists of relevant features are provided (appendix 1.). For the purposes of the following discussion only good, representative examples will be mentioned.

Walls

Two types of wall were identified at *Lemba* which still bear some validity although the second type must now be regarded as a type 4 wall set on a type 4 foundation. Five very specific classes of walling can now be distinguished based on more complete archaeological remains and upon a better understanding of prehistoric technology and building practices achieved through experimental work and a knowledge of site formation processes (see appendix 2). In particular, greater familiarity with soil construction methods has allowed a revision of the archaeological data and the identification and isolation of the various elements of foundation and wall construction (see 2.3 above). One further outcome of this work is the view that the term pisé has been ill advisedly or incorrectly used and must now either be totally disregarded in the context of Cypriot prehistory or used with *extreme* caution. The terms "mudwall" or "soil-constructed" are to be preferred.

It was suggested in the *Lemba* report (*LAP* 1, 219) that many of the walls (*Lemba* type 2) were stone built for their entire height. There are only a few instances, in **B3** and possibly in **B834** and **B1016** at *Kissonerga*, where this can be confirmed on the basis of the preserved height of the wall and the extent of the stone collapse. This is characteristic of period 4 at *Kissonerga* and is referred to as stonewall construction. For the rest of the site, the sheer volume of stone needed to support such a proposition does not survive in any form. The identification, however, of intact and *in situ* structural mud (see 3.3 below) in some of the walls has provided the most reliable clue as to the nature of their upper part. Compact mud frequently with mineral inclusions and the casts of organic binder material exists in a form which has not been subject to erosional breakdown and which, therefore, should be considered as part of the original structure of the wall. Similar vitrified material from the site also preserves the mineral and organic structure of the mud as a building material. This material does not survive merely as a mud mortar to secure and bind the stone work of a stone constructed wall. That aim can be more than adequately achieved by the use of a soil and water mixture alone (see 2.4 above). The processing of mud with a control being exercised over the type and grade of mineral content and the deliberate inclusion of organic material is a much more complex procedure developed where soil is the main or sole structural element in a building. Its occurrence on top of the lower basal courses of the walls at *Kissonerga* is significant and suggests that such construction methods were practised on the site. It is reasonable, then, to believe that the majority of buildings at *Kissonerga* for period 3 and possibly also from period 4 were constructed in mudwall.

Type 1

Surviving only as a low earth bank set directly on to the ground and with occasional facing stones embedded into its inner face, this type of wall is not common at *Kissonerga* but is well represented at *Lemba* Area 1 (*LAP* 1, 219). The denuded nature of some of the *Kissonerga* structures and the more elaborate methods of foundation construction which involved laying a primary mud and pebble course frequently gives the appearance of a type 1 wall. This is most noticeable in a short stretch of wall, 943, in **B994** (fig 25) and in the western stretch of wall 1004 in **B1016** (fig. 17-18). In both cases the better preserved sections of wall are of type 3. A possible example of a type 1 wall at *Kissonerga* occurs with wall 75 in **B98**, although here there is better use of facing stones on the exterior face as well as solidly constructed door jambs (fig. 39). However, it may be that in this instance also, a type 3 wall has been eroded or dismantled down to foundation level giving a slightly deceptive appearance. The balance of evidence suggests that this is the case and that the type 1 wall is specific to *Lemba* Area I in early period 3a.

Type 2

A variant of the above appears at both *Lemba* Area II, **B19** in period 3a, and at *Kissonerga*, **B1** in period 4. It is also possible that the wall of *Lemba* **B20** from period 3b is of this type although here the excessive amount of plough damage makes any firm statement difficult (*LAP*.1. fig 30). As with type 1 the wall survives as a low earth bank, heavily eroded and irregular, incorporating occasional stones, broken artefacts and sherdage material. In **B1** at *Kissonerga* this included the greater part of a RW spouted bowl (KM400) which had been smashed and incorporated in the E butt of what may have been the doorway (fig. 39). The original width of the wall is now unknown due to its eroded nature although wall 9, **B1**, ranges between 0.30-0.50m.

The characteristic feature differentiating this from type 1 walls is the presence of a ring of post holes set back 0.10-0.20m from the exterior of the mud wall. In the *Lemba* **B19** example where this has been noted the posts are very shallow rarely reaching a depth of more than a few centimetres, in contrast to **B1** *Kissonerga* where the posts are quite clear, vertical sided holes with diameters of 0.12-0.18m and depths of up to 0.25m. This suggests the holes were dug to receive upright posts around the exterior of the structure and were not the slots for the angled posts of a conical roof as has been suggested (*LAP* 1, 221). A similar arrangement has also been recorded at *Erimi* (Dikaios 1936, Hut XIIIB, 22) where an arc of five postholes along the exterior of a mud and pebble bank occurred in the latest deposits (XIII) on the site. The depths or declinations of the postholes are not indicated. Mention is also made of such constructions in the earliest deposits, layers III & IV, although the evidence is so poorly preserved as to make an assessment impossible. Arrangements of postholes set around shallow hollows, some containing floor surfaces have been recorded from many EChal sites. There is increasing evidence to suggest that these may originally have structures with walls similar to those of **B19** at *Lemba* and **B1** at *Kissonerga*. The earliest mention of them is by Dikaios from his excavations at Kalavassos *Pamboules* and *Kokkinoyia* where several such examples are noted. The large hollow, F1, at *Mylouthkia* and the much better preserved structure **B152** also from that site are further examples of this arrangement. In the latter structure the presence of well preserved *in situ* fixtures on the floor as well as structural mud debris in the fill has elevated **B152** to the status of a building (appendix 3). At *Kissonerga* itself, deposits beneath **B1016** and **B1547** have been assigned to period 2 and are characterised by hollows around which postholes have been detected. It may well be that these examples do represent buildings which, due to the nature of the structures are more prone to severe erosion and are less likely to survive within the archaeological record.

Type 3

By far the most common type of walling found on site survives largely as a stone plinth only and occurs in MChal levels at both *Lemba* in period 3b and at *Kissonerga* in period 3. The *Erimi* structures from levels VII-XIII also appear to be of this type as do the walls of *Kythrea* Huts I-III.

Although the general way in which these MChal walls and the later LChal walls are put together is consistent there is a marked difference in the details of construction between the two periods. It is, therefore, possible to define two very distinct wall types, labelled here types 3 and 4, the former characteristic only of MChal levels and the latter only of LChal. There is, however, a gradation between the two which appears in both periods where characteristics of both may appear and which will be referred to as type 3/4. This is an entirely artificial group and probably reflects the state of preservation of a building rather than the true status of its wall.

. The period 3a and 3b structures at *Kissonerga* are the best preserved and illustrate clearly how these walls were constructed. Large blocks (0.40m x 0.50m) of calcareous sandstone and calcarenite, some from eroded coastal outcrops as well as harder, more rounded rock types from riverine deposits were selected and placed with one broad, flatish surface facing outwards to form the inner or outer faces of the wall and with the irregular body of the stone projecting inwards. Experience gained from working with this stone has demonstrated that, in cases, a very rough shaping of the stone to form a flat face has also taken place. The core of the wall is formed from mud and smaller irregular stones which binds the inner and outer face together. The use of artefacts, either in the core or as facing stones, does occur but is far less common than in wall types 1 and 2. In the larger walls, especially 165 of **B206**, mud is not used excessively and large gaps or voids may occur although this does not constitute dry stone construction (fig. 21-22).

Widths of the wall base range between 0.40m and 0.75, although when wall 168 of **B206** is included this increases to 0.85m. Several courses are usually preserved up to a recorded maximum of 4-5 courses in 168 of **B206** and 831 of **B855** (fig. 24), giving a maximum height for the stone plinth of 0.56m-0.60m. The plinth of walls 34 in **B2** (fig. 19-20), 29 in **B4** (fig. 23) and 943 of **B994** (fig. 25) are lower affairs being only 2 courses high. Uneroded structural mud with the organic casts of straw chaff preserved was collected from the top of the plinths in **B206** and **B4** and similar stretches are recorded in **B4** and **B855** providing strong evidence for a mud structure in the upper part of these walls.

In the absence of more substantial information it must also be assumed that this was the type of wall construction favoured in the rectilinear buildings, **B1000**, **B1161** and **B1295**, at *Kissonerga*. The spread of stones, 1108, some set roughly on edge, along the western side of wall 1109 in **B1161** has the appearance of collapsed stone walling raising the possibility that these walls were entirely stone built with no mud superstructure. The field notes mention the presence of "structural pisé" from amongst the stones of 1108 which could confirm this view. However, fine material eroded down from surrounding structures or blown in from further afield would also form compacted, hard deposits which would be protected and contained by the stones giving the appearance of *in situ* structural material. In view of the failure to articulate the meaning of "structural" in the field notes and the general misuse of the term "pisé" it is necessary to disregard this evidence and to base any assessment purely upon the visual appearance of the stones. Certainly this section of wall shows considerable variation in width with clear divisions in construction and one possible door blocking. It is not unreasonable, therefore, to assume that collapse and repair had occurred at some point. The presence, then, of 1108 is not unexpected but it must be borne in that this could as easily be interpreted as the uncleared debris from the repair of the stone plinth as from the collapse of the upper wall.

The quality of evidence from *Lemba* is not as good but enough exists to confirm the presence of this wall type during the MChal phases (period 2). An arc of walling from **B1** typifies this form of construction with the arrangement, size and type of stone reflecting that at *Kissonerga* (*LAP* 2.1). The preserved arcs of walling of Huts VI-XIIA and C at *Erimi* follow a similar pattern of construction of limestone blocks being used as facing stones bonded by a rubble core. Dikaios also mentions a consistent vertical, inward curve on this type of wall (Dikaios 1936, 14). This has not been noted at either *Lemba* or *Kissonerga* and it may be an illusory result of the slightly dished nature of many of the floors (see "Floors" below) and the method of plastering the walls which frequently resulted in an exaggerated curve from the walls down along the floor (see "Wall Finish" below). More contentious is his description of "postholes formed of small stones, set with rubble and lime.." on top of the stone footing or plinth (Dikaios 1936, 14). This arrangement has not once been noticed at *Lemba* or *Kissonerga* and in the absence of the presentation of any supporting published visual evidence, cannot be corroborated.

Type 4

Similar in form to the type 3 wall but using, in general, much smaller stones giving little distinction between facing and core material and incorporating a much greater volume of mud in the construction. This type of wall is characteristic mainly of LChal deposits at *Lemba*, period 4, and *Kissonerga,* period 4. There is evidence that this type of stone construction may have been carried up to full wall height although structural mud has also been found possibly indicating a mixed form of construction.

The use of smaller stones and the greater quantities of mud give the appearance of a deterioration in construction methods from type 3 walls. However, this is not necessarily the case as an examination of the walls and familiarity of the technique through experimental archaeology has shown. The basic construction method of inner and outer facing stones bonded together with a mud and rubble core still persists. Stretches of wall with larger facing stones are to be found in places, for example, wall 46 of **B3** (fig. 31-3), the western part of wall 87 in **B86** (fig. 34), wall 858 in **B834** (fig. 36) and wall 975 in B**1052** (fig. 37-8), all at *Kissonerga* and also in the *Lemba* period 4 buildings. A variation is also seen in 186 of **B200** where larger stones project through the wall from face to face at intervals giving it a greater degree of structural stability. However, there are period 4 walls from *Kissonerga*, wall 194 of **B204** (fig. 35), 1047 of **B1046** (fig. 37, 40), and most of 87 in **B86** where the characteristics of this type of wall are more evidently displayed. In the case of the wall of **B86**, greater care appears to have been taken with the internal face than with the exterior which has a much more rubble like appearance. This, indeed, has many similarities with type 1 wall from Area 1 at *Lemba* in which the inner face only is seen to be built up with more regularly placed stones.

Clearly there is a grey area between wall types 3 and 4 and it may be wrong, as stated previously, to try to force a rigid demarcation. There is some evidence, particularly at *Kissonerga* from wall 46 of **B3**, wall 858 of **B834** and possibly also wall 796 of **B1165** where the height of the wall, 0.78m in the case of **B3**, or the extent of stone spread suggests a form of superstructure quite different from type 3 walls . Buildings **B2-3** at *Lemba* have walls in which the use of considerable amounts of stone is probable with an estimated 10 courses of stone construction giving an original height of 0.80-0.90m in **B3** (*LAP* 1, 118). On the analogy of experimental work at *Lemba* in **RH3** this could be even greater; up to 1.50m (see 4.3 below). It may be that the stone built element of the wall was carried to a much higher level than in type 3 walls, up to half the height of the wall, or, indeed that the entire wall was built in this fashion. The main exception to this is 186 of **B200** where a stretch of wall in the SW of the building is composed entirely of a red soil with clear impressions of the chaff binder being preserved. A similar patch also appears in the NE of the wall. However, this merely suggest that pure stretches either of mud or of stone may have been used during the construction of a wall but that its basic form was a mixture of the two. Obviously, though, the use of actual structural mud rather than just a mud mortar indicates that the mud played as important a part structurally as did the stone. To say with certainty that the upper parts of these walls were constructed in one way or the other, is on present criteria, problematic but the balance of the evidence does seem to point to a stone and mud rather than a purely mudwall type.

Type 5

A variant on the stone wall construction and found in only two instances at *Kissonerga* is the rubble built wall. Constructed of large irregular stones with smaller infill stones and mud this wall is very roughly built and is usually only the width of one large stone. Wall 362 of **B376** (fig. 35) typifies this type of construction although in places, it is seen to develop into a type 3/4 wall. The SW corner of **B1161**, 1691, is also built in this fashion and may represent either the blocking of a door or the hasty repair to a collapsed section of wall (fig. 27). This rough type of wall has not been recorded at *Lemba* or at *Erimi.*

Type 6

Postholes, for the support of a timber upright, are frequently found in association with structural remains although rarely in any discernible pattern. The exceptions are the type 2 walls of **B19** at *Lemba* and **B1** at *Kissonerga* and the group of 12-13 postholes, 266-275, discovered beneath **B98** at *Kissonerga* with associated plaster platform, 308, and three graves; 505, 506 and 511. This group, designated **B375**, is the only instance at *Kissonerga* where postholes have been clearly observed to define the enclosing element of a space. In this respect it is possible to view this element as a wall with timber uprights. A double row of posts can be identified but the construction of **B98** immediately over this has effectively destroyed any associated deposits making it impossible to determine whether these posts were free-standing or whether they were part of a solid structure. Further possible timber upright walls may be seen at *Lemba* **B18**, although these may be the internal posts of a building defined by a heavily eroded type 1 wall to the W. A group of five postholes to the NE of this in N21c centred on a hearth, two basins and some pits is another possible candidate.

Excavations at the site of *Maa-Palaeokastro* on a headland heavily eroded since its Chalcolithic occupation have defined a circular timber structure, 69, of the EChal period (Thomas 1988, 272 and Fig 1, 268). Dikaios also describes possible post structures in Huts III and IV at *Erimi* (1936, 8) and at *Kalavassos-Pamboules* (Dikaios and Stewart 1962, 134).

Type 7

From the recent excavations at Kissonerga *Mylouthkia* the first example of a wall of an EChal house has been uncovered in **B200** (Thomas 1995). Contrary to all expectations influenced by the *Lemba* Area 1 constructions, the building has proved to be a far more substantial affair than imagined (fig. 8, 10-11). The wall has been massively constructed and ranges between 0.60-0.80m wide standing up to 0.60m high in places. It appears to be an entirely mud and stone construction for its entire height with no evidence that the preserved height is a stone plinth supporting a mud superstructure. Large blocks have been roughly laid to form an inner and an outer face with a mud and rubble core although, in places, the core is seen also to be the wall face. Along parts of the N arc of the wall large blocks have also been laid through the entire wall width with no rubble core at all. Small blocks and stones are seen at other parts to sit on the very edge of the wall face with no attempt to bond them in to the wall apart from a rough mortar. Mud is used quite extensively throughout with patches where no stones are present It is a very shoddy and inherently unstable construction method producing an irregular, rubble-like structure. Along the inner face to the E of the entrance a section of the render was removed during excavation revealing a wall face which gives the appearance of having been stripped of its facing to expose the core material. This may indeed be a clue to the technique behind the wall. A very thick mud render, 0.10-0.15m thick, was liberally applied to both the inner and the outer faces of the wall smoothing it out and giving it a much more substantial aspect. In order for such a wall to have much durability or credence as a building method it may well be that this thick render was actually an integral part of the wall and cannot be viewed merely as a sacrificial protective layer. From this point of view the wall looks much more appealing particularly with regards to the substantial nature of the building itself.

No other example of this extraordinary type of wall appears anywhere else in the Chalcolithic of Cyprus. Whether or not this is peculiar to *Mylouthkia* or even to **B200** is unknown and, in the absence of any other exposures of preserved *in situ* EChal sites, this is likely to remain the case. Its appearance at that time and on that site, however, is remarkable.

Foundations

A " foundation" in this case is defined as the initial preparation of the ground or site before the first courses of the wall are established. The type of foundation can vary greatly according to the size and complexity of the structure being erected and its definition is based on evidence derived mainly from the site of *Kissonerga* where a greater variety of data exists. In all cases, the effect of any foundation work is the creation of a level and uniform surface upon which the building could be constructed. At *Kissonerga* in particular situated, as it is, on the N side of a shallow valley sloping gently down to the Skotinis R, this generally involved some form of terracing and levelling. A type 3 foundation occurs only in period 3 buildings at *Kissonerga* and type 4 has been noted only once under **B855** also at *Kissonerga*. Type 1 is not period specific with type 2 representing a more developed version of it from the MChal onward; both probably representing the "normal" type of foundation construction in the absence of any specific requirements of a particular site. Not all buildings necessarily show evidence of site preparation prior to their construction and in many cases it may have been so ephemeral as to escape detection during excavation. This would apply particularly to type 1 foundations.

Type 1

A shallow dished depression or hollow with the wall of the structure set directly on to the ground at the edge of the depression appears to be the standard way in which the site was prepared before construction. In areas where the wall of a building has been removed it is possible to see the hollow more clearly as in the N sector of **B1** or along the SE sector of **B1565**. Elsewhere this can only be determined where the doorway and profile through it have been preserved as in **B86**, **B204** or **B1046**. Frequently, with a type 1 foundation, the shallowness of the hollow makes the positioning of the wall on the edge of the cut or inside it difficult to determine and indeed renders it almost meaningless.

The size of the hollow, is of course, dependent upon the diameter of the building and is frequently so shallow as to be detectable in profile only. In other instances, **B1046** at *Kissonerga* for example, the dip can be quite steep reaching a maximum depth at the centre of 0.30-0.50m. The buildings of period 1 at *Lemba* in Area 1 typify this foundation and demonstrate its existence from the earlier phases of the Chalcolithic surviving through to the closing phases of occupation as seen at *Kissonerga* period 4. **B5** is a particularly good example of this where the irregular nature of the hollow cut into the bedrock can clearly be seen (*LAP*1, fig 12-13). In this case the frequency of rebuilding has divorced the original hollow **B5:7** from the later structures resulting in a hollow slightly smaller than the size of the preserved buildings. One further aspect of the foundation of this building is the foundation "trench" dug along the northern arc to receive the wall in **B5.3/4**. This is intriguing and may indeed hint that a foundation trench was the initial stage of wall construction with the 'hollow' effect being created later, possibly as a result of the construction process or as a deliberate step in the creation of the building interior.

Type 2

Similar to the above but with the hollow being more clearly cut and terraced, and with the wall of the building set immediately inside the edge of the cut, this type of foundation is characteristic of MChal buildings and of some of the larger LChal structures. Clear examples of the terracing and the broad, flatter nature of the hollow can be seen with **B994**, **B4** and **B200** at *Kissonerga*. Frequently, in buildings of this period, the gap between the wall and the edge of the terrace cut is packed with small stones, pebbles and mud. The N arc of **B2** and **B4** at *Kissonerga* and **B4** at *Lemba* show good *in situ* examples of this. The preserved section of wall in **B206** shows how substantial this stone packing can become where 1362 appears almost as another skin to the wall. Its badly constructed nature with the 'balancing' of stones one on top of the other rather than 'fitting' them together to give interlocking support as would be expected in a drystone construction, strongly suggests the use of a mud mortar and indicates its possible function as the basal support or protection for the mud wall and its render.

Of interest also in the section through the N part of the wall and foundation of **B206** (fig. 21-2) is the double step of the foundation hollow to accommodate the wall 168 and the 'stone packing' 1370 on separate platforms. A later wall or pier, 147, is clearly seen to overlie 1370 indicating that 1370 either did not extend much beyond its present height or that it has fallen out of use.

Also to be included in this group are structures of the LChal period, most notably **B3**, **B834**, **B1016** and **B1052**. In the latter two buildings the foundation cut is still clearly visible with the wall set inside it while **B3** exhibits a massive attempt at terracing with the cut reaching a depth of 0.37m at its edge. The extreme difficulty with which this was detected in excavation indicates the fragility of this type of evidence.

Type 3

A variation of the terraced hollow occurs in two of the MChal rectilinear structures **B1000** and **B1295** at *Kissonerga*. Set in a rectilinear hollow the wall of the building is established partly on the edge of the cut but mainly over a foundation which has been roughly built of pebbles and mud against the face of the cut. The digging of the later grave, 559, has effectively sectioned the wall of **B1295** where this type of foundation can most clearly be seen. In this particular section the wall sits entirely upon the mud and cobble foundation and not on the edge of the cut. In the case of both **B1000** and **B1295** which have some evidence for this type of foundation, the walls have been left *in situ* so it is not possible to examine the full circuit of the building for foundation type. However, the SW corner of both buildings is severely denuded and in both instances it is evident that the wall rests directly on the ground surface indicating that the rubble and mud foundation was used only on the upper, terraced part of the hollow.

Type 4

A most unusual and massively built type of foundation construction has been detected beneath the W side of **B855** at *Kissonerga* where the severe erosion and destruction of that part of the building has allowed investigation beneath a major MChal structure (fig. 24). The foundation, 2066, consists of a bed of massive, flat stones following the arc of the building and extending inwards beneath the building for 2.0m. Along the outer edge good facing stones, selected for their size and shape, have been set giving a regular and solid footing for the wall construction. A homogeneous compact clay/loam material with gritty inclusions indicates a form of mud mortar may have been used to consolidate the structure. Had it been a dry stone construction, voids with silts and finely sorted a sand/gravel would have been detected. Later pits and graves have removed this construction to the N as well as destroying most of **B855** in that area. All that was detected was the floor of the building, 952, spreading over the eastern part of the foundation 2066.

Entrances

A total of 18 entrances in 16 buildings in varying states of completeness have been recorded at *Kissonerga*. A further seven entrances at *Lemba* and two at *Erimi* contribute considerably to this aspect of building construction. In all buildings the doorway forms a potential point of weakness in the structure necessitating special care with the foundation courses or finishing of the wall in this area as well as particular arrangements for closing and securing the gap. A range of solutions to this problem can now be observed at *Lemba* and *Kissonerga* with in cases, different elements being preferred for different building or wall types. A standard entrance type composed of varying elements can now be defined. The definition of doorway arrangements has been facilitated by the discovery in 1988 of a MChal ceramic model of a building, KM 1446, in a pit, 1015, beneath the wall of **B994** at *Kissonerga* (*LAP* II.2 and see 3.5 below). In the model, a solid door attached to a post pivots inwards to the left on a socketed element in the floor supported at the top by a looped bracket embedded in the wall. All known occurrences of the *in situ* position of a socketed door stone at *Kissonerga*, *Lemba* and *Erimi* are identical to that of the building model indicating a door which opens inwards to the left when entering and suggest some consistency in the pattern of doorway arrangements throughout the Chalcolithic periods. Most excavated evidence, however, pertains to LChal buildings leaving KM 1444 as the clearest evidence of how these arrangements were made in the MChal period.

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From the location of the preserved entranceways it is apparent that there was a shift in orientation of doorways throughout the life of the sites at *Lemba* and *Kissonerga.* The earliest of these is from the group of structures in Area I at *Lemba*, **B6, 8, 9, 16** and possibly **B5**. If the positions of the socketed stones are significant, then all face the SE. The MChal buildings of period 3 at *Kissonerga* are less satisfactory in this respect with only three clearly preserved entrances, two in **B1161** and one in **B2**. It is also probable that the E butt of the entrance is preserved in **B4** and an area of flat stones with a socketed stone, KM 5038, may indicate the entrance in **B1000**. The preserved arcs of walling in **B855, B4, B206** and **B1103** preclude an east facing entrance in these buildings. All of these point to an entrance orientation in the SW quadrant and shows a shift from the earlier *Lemba* Area I position. Whether this reflects a transition of cultural norms between periods or is indication of other factors at work, for instance, site specific considerations, is not known. Recent excavations at Kissonerga *Mylouthkia* have now uncovered an EChal building in which the primary entrance is located in the SW quadrant (appendix 3). However, for the MChal period this SW orientation is entirely consistent with the demonstrated relationship between the doorway and the ridged floor area of building model KM1444 which, when located in its pit was orientated with the doorway facing SW placing the entrance hard up against the side of pit 1015. The arrangement, however, was also consistent with the location of the "segmented" floor area in the SE quadrant of the model as it appears in excavated buildings. Huts VIA-IXA and XIIIA from contemporary levels at *Erimi* are also orientated in this general direction. Only entrance 2003 in **B1161** at *Kissonerga* is anomalous in its eastward orientation.

By the LChal period 4 levels at *Kissonerga* a marked change in patterns of orientation is noticeable. By far the majority of structures face either S or SE, for example, **B1, B3, B86, B98, B200, B375, B736, B834** and **B1165**. This is also the case with period 4 buildings at *Lemba*; **B2, B3** and **B7**. However, there are quite a large number of period 4 structures at *Kissonerga* in which the entrances face W and NW and one possible NE side entrance in **B86**. These are found in **B204, B1044, B1046** and **B1052**. The impression gained is that during the LChal, orientation is controlled less by a standard cultural format or by prevailing environmental conditions than it is during the MChal period.. The suggestion at *Lemba* (*LAP* 1, 232) that groups of buildings reflect households with specialised function rooms arranged around an open "yard" area may indeed be the case. This type of arrangement would impose a more organised pattern on the *Kissonerga* period 4 village layout than is immediately apparent.

In many structures the doorway survives only as a gap in the wall although in some cases, particularly when stone footings are used, this can be more clearly defined. In **B86, B200, B1161** and **B1547** the usual wall construction pattern of inner and outer facing stones is interrupted at the entrance gap where larger stones are placed to create a more robust jamb for the doorway. This method is also used in **B98** in a type 1/4 wall where large stones with a long flat face are placed across the wall at either jamb. In two period 4 buildings, **B204** and **B1052**, this is seen to result in a considerable thickening of the wall at the door jamb increasing the basal wall width by a third or a quarter. A similar slight thickening has also been noticed in the period 4 building at *Lemba*, **B3,** and in two period 3a buildings **B9** and **B16**. How far the latter are the result of collapse or erosion patterns is difficult to determine but in view of the heavily eroded nature of these walls it may be prudent to resist viewing it as an early characteristic of doorway construction and to restrict it to LChal buildings where this is more clearly seen.

Threshold areas are formed in three different ways. Stone built sills occur in **B3** and **B86**, the former as a set of flat stones across the entrance and the latter as a single flat slab. Entrance threshold 2002 in **B1161** is also stone built in much the same way that a wall would be with inner and outer facing stones and a rubble core. Indeed, if this is a secondary entrance with a primary entrance being the blocked gap, 1691, in the SW corner, then this threshold may actually be the base of the wall. The group of flat slabs along the line of the SW wall in **B1000** may also represent an entrance threshold. A stone threshold similar to **B3** also occurs in **B3** at *Lemba* while at *Erimi* Hut VIA has produced one with a simple, flat slab. More commonly entrance thresholds are of plain earth compacted from use and sloping down into the building following the line of the dished slope of the floor. In **B834, B1052** and **B1046** good examples of this show a continuous surface dipping downwards into the building where it becomes part of the floor. The level of the floor on **B1**, **B98** and **B204**, however, is higher than the exterior surfaces around them entailing a step up into the building. This can also be seen in **B16** at *Lemba.* Finely constructed thresholds in pebbles and lime plaster were first noticed at *Lemba* in **B2** and **B3** where the plaster was seen to extend outwards to form a porch or floor outside the entrance (*LAPI*.1, 114 & 119). Dikaios also describes "*...layers of lime mixed with gravel...*" covering the threshold area of Hut XIIIA (Dikaios 1936, 22). A similar sort of paving but in clay was uncovered over the threshold and extending in an apron outside the entrance of **B200** at *Kissonerga.* A remodelling of this building which involved laying a new floor and raising the threshold has preserved this fairly fragile clay surface which may not otherwise have survived.

The building model KM 1446 demonstrates how the door pivots on a post set onto a support just inside the doorway. Pivot stones with rotationally wear-marked cups or sockets are frequently found in just such a position inside the doorway on the left when entering. Nine, *in situ*, examples have been recovered at *Kissonerga*; **B3, B98, B204, B834, B1044, B1046, B1052, B1161** and **B1165**; two at *Lemba*; **B3** and **B16**; and one at *Erimi*; Hut XIIIA. These occur throughout the Chalcolithic periods.

Stakeholes commonly occur in most situations on site but in only three instances; **B8** and **B16** at *Lemba*, and Hut XIIIA at *Erimi* do they appear to be in direct association with doorway arrangements. In all three cases a row or group of 308 small holes lie along the inner edge of the threshold. Dikaios interprets these as a method for bolting the door (1936, 22). Although stakeholes do survive in abundance at *Kissonerga*, especially outside **B1**, **B98**, **B86** and **B204**, no similar arrangement has been noted at that site.

One further element which is increasingly coming to be regarded as being part of the doorway arrangements is the edge-set stone located on the floor, centrally positioned to the door and lying 1.0-1.5m inside the building. This generally places it directly before the central hearth. The stone used is, in most cases, a broken fragment of a saddle quern set in order to present its longest axis towards the door. In all but two instances where such a stone has been recorded its position is always directly between the hearth and the door. The two exceptions come from **B855** and **B1295** where no doorway was preserved. The **B1295** example may indeed be a clue as to the original position of the door but in **B855** the location of 1706 would place the door in a position inconsistent with the arrangements of other structures of that period and, in the absence of more supportive evidence, should be treated with caution. However, excluding these two examples, the consistent juxtaposition of doorway and edge-set stone argues a direct relationship between the two making the stone part of the doorway arrangements. Seven occurrences of this setting have been recorded at *Kissonerga* in **B1**, **B98**, **B834**, **B1044**, **B1046**, **B1052** and **B1165**, all form period 4 LChal levels. In all LChal buildings at *Kissonerga* which are sufficiently well preserved this arrangement has been noted apart from **B200**, **B86**, **B203** and **B376**. In **B204** and **B376** the buildings are badly damaged and cut by later pits which makes an assessment difficult. In **B86** a broken fragment of quernstone, KM 596, does lie on the floor just inside the doorway while **B200** with its unique paving is an anomalous structure falling outwith any considerations of 'standard' building arrangements. At *Lemba*, **B3** F30, a shallow pit in front of the hearth also contains an upright quern (*LAP* II.1, 119), again a period 3 LChal building. No such setting was ever recorded at *Erimi*. The only earlier occurrences of such a setting come from a period 3a, building at *Lemba*, **B6**, where a rubber stone is set on edge into the floor directly in front of and touching the hearth F8; and from a period 3A MChal building at *Kissonerga*, **B1547**. In this instance a small cupped stone and a flat faced stone, 1704, were found set into the floor one behind the other along the line of the radial ridge directly in front of the door. The similarity of these two examples to the LChal arrangements is not entirely convincing and may only represent a fortuitous relationship to the doorway. However, they cannot be ruled out completely and it may well be that this type of setting did exist in earlier periods but was not a standard fixture.

Doorstops consisting of small stones set upright or embedded into the ground at the interior jamb on the right upon entering have observed in two cases. In **B1547** it is embedded in the radial ridge where it intersects with wall while in **B3** it may be a slightly more complicated arrangement which is now badly disturbed.

In three buildings at *Kissonerga* the blocking of entrances seems to have taken place. The clearest of these, 1603/5 in **B834**, is a mud and stone constructed plug standing to the preserved height of the walls and forming an inner and outer face consistent with the wall width. There is some speculation that this may have been the result of raised "floor" levels within the building but this is not entirely convincing as many of the supposed later floor levels are actually consistent with erosion patterns within that building. A similar block of mud and small stones, 1605, was also uncovered in the entrance of **B1547**. In this instance the 'blocking' is slightly larger than the doorway itself, projecting outwards for 0.30-0.40m. The walls of this structure are preserved to a height of only 0.25m and the W side of the building including the W door jamb are missing making it difficult to judge the original extent of 1605. A different type of blocking has been recorded in **B1161** in which a doorway in the S corner of the building with thickened wall terminals and a pivot stone, 1690, set on the left inside the N door jamb was sealed with a section of type 5 rubble walling, 1691. This blocking was only half of the thickness of the wall at that point creating, in effect, what would have been a niche in the S corner of the building.

In most excavated examples of entrances the evidence from any one building is fairly incomplete particularly with MChal structures. However, different general patterns of doorway arrangements can be defined, although these may not be regarded as a complete repertoire.

Type 1

This entranceway occurs in buildings with walls of type 1-2. Where preserved some care appears to have been taken with the door jambs either in the form of slightly thickened wall terminals or larger basal course stones being laid across the jamb. A step or slight ramp up into the building is not uncommon and a pivot stone is set into the floor on the left upon entering. Stakeholes, either in a row or a distinct group can occur on the threshold. Widths of doorways vary between c.0.50-0.70m and the general orientation of the entrance is to the S and SE.

Type 2

Known most clearly from the building model KM 1446 this entrance arrangement occurs with type 3 walls with carefully constructed stone door jambs in the base courses. The jambs retain the same thickness as the walls and the threshold may be stone paved or, occasionally, finished off in a thick lime plaster and pebble layer. Doorway widths can be 1.0m or more. A pivot stone is set into the floor on the left when entering and doorways are generally orientated to the S and SW. Complete examples of this type of doorway do not exist due to the severe erosion or destruction of most buildings at *Kissonerga* in the SW quadrant. Doorway widths are surmised from gaps in walls and the presence of a pivot stone from the building model KM 1446. This type is confined to period 3b, MChal, buildings at *Kissonerga* and Area II at *Lemba.*

Type 3

This is by far the best represented type of doorway and is found largely in LChal buildings at *Kissonerga* and in **B3** at *Lemba.* It occurs only with type 4 walls which can be built up with slightly larger stones to form door jambs sometimes resulting in a thickening of the wall terminal. Thresholds are commonly of earth sloping down into the building although stone built thresholds are also known. Again a pivot stone is set into the floor on the left when entering but the most characteristic feature is the broken fragment of quernstone set on edge into the floor c.10.0-1.5m directly in from the entrance. Widths of doorways tend to be large in respect to building size ranging from 0.60-1.0m. Orientation follows no consistent pattern with the S/W or W/NW being favoured although an examination of the position and orientation of other buildings may indicate groupings around a communal space.

Type 4

The occasional appearance of gaps in otherwise intact stretches of wall may indicate the presence of an entrance. In the absence of any special doorway arrangements in these cases we may assume that these were general points of access, perhaps punched through the wall after the structure had ceased to serve its original function. Erosion or deliberate vandalism may also be factors contributing to the present appearance of these "entrances".

Floors

In many ways the floor of a building can be the only element which survives archaeologically despite being subject to the considerable post-occupational alteration. Fragile or unstable surfaces are prone to erosion or destruction when exposed and to alteration when buried and subjected to soil formation processes. Frequently, a surface may cease to exist in its original from or an apparent surface may be created through processes which are unrelated to the human occupation of a site . It is for this reason that the section on floor types more than any other section may reflect a combination of actual constructed floors and the results of erosional or post depositional processes. This is particularly true of the first three types.

Type 1

The earth floor, commonly referred to by excavators as "trampled earth floors" or "beaten earth floors" is perhaps the most deceptive and elusive. There is no evidence to suggest, in a Chalcolithic context, that any special treatment was given to the preparation of an earthen floor. Indeed, the use of terms like 'trample' or beaten' is prejudicial to its understanding and should be discontinued. These terms are more correctly applied to recent ethnographic instances of special floor preparation using specific soil types mixed with organic and mineral elements and laid in a specific, and labour intensive, manner. In Chalcolithic buildings this has not been recorded. Bare earth floors most certainly did exist inside Chalcolithic buildings of all periods but their identification can be, at times, difficult and frustrating. In particular, this type of surface begs the question of what is floor and what is underlying deposit upon which a floor is founded. In effect the floor is merely the compacted surface of whatever underlies the building after the foundations have been created. The inability, at times, to find such "floors", particularly around the edges of buildings is a reflection of how that building may have been used with the greatest degree of compaction in the central, more accessible, areas. Conversely, the burial of such a floor subjects it to renewed processes of soil formation in which the structure of its one characteristic element, surface compaction, may largely be destroyed through the activities of worms, insects or vegetation growth as the soil itself is restructured. The increasing build up of deposits inside a building may also result in the creation of false surfaces as fine silts are washed or blown in or deposited with surface puddling causing the structural realignment of clay platelets at an erosion interface creating the surface. The slight depression formed by a collapsed or destroyed building would provide an ideal location for such processes to take place . In effect then, the earth floor can only be identified confidently when in conjunction with *in situ* artefactual and architectural remains.

Type 2

A very particular type of floor construction was identified in *Lemba* period 3a buildings in Area I by virtue of the very distinctive greenish colour of the bentonitic clay used. It was apparent that floors were, in cases, deliberately made up from selected materials and spread or laid inside the buildings. The excavator also observes what appears to have been a finish of a fine and very thin layer of "plaster". No examples of this "plaster" are preserved so it is difficult to determine whether or not it is the result of true lime plaster production, the spreading of havara powder or the erosion or puddling of the clay floor forming this distinctive surface. The use of some form of plastering does appear in other elements of *Lemba* period 3a buildings so its use on floors is not unexpected but, again, the exact nature of the plaster is not known.

The seven period 3a buildings at *Lemba* Area I have, floors made up in this fashion. The primary element in such a floor is the use of clay applied to the ground surface inside the building and possibly with some form of plaster surfacing. It was initially thought that the laying of the floor, or at least the clay layer, preceded the construction of the wall, particularly in **B5** where it is seen to run under the wall. However, this should now be seen as the collapse or reconstruction of walls onto earlier floors - a fragile plaster and clay floor would not survive the construction process in a usable state (see 4.3 below).

Red clay floors are described by Dikaios in several buildings at *Erimi* in layer V, Huts VI-VIIIA and Hut VIIIB although he also refers to "beaten earth" floors (see *supra*). No mention is made of a plaster surface in these cases. In **B1** at *Kissonerga*, a building badly damaged by ploughing, there is some evidence of levelling up or consolidating the floor of the building with a layer of rubble like material (fig. 39). This, however, is not of the quality of the *Lemba* floors and may only be an individual solution adopted in that particular building. Also from *Kissonerga* comes floor 1546 with its ridges in **B1547** (fig. 15-16). The floor occupies the E third of the building and is bounded by two low mud ridges, 1548, which were constructed as part of the floor. It is well constructed, solid and shows no signs of heavy wear or erosion. However, the differences in form between the two floors are considerable although the materials and method of construction may have a lot in common.

Prepared earth or clay floors are, therefore, a consistent element throughout the Chalcolithic being particularly popular in earlier periods when a thin layer of what may be plaster was also applied. By the MChal, period 3a at *Kissonerga*, it was apparent from **B1547** that a more sophisticated understanding of mud as a flooring material had been achieved with the construction of a solid, level earth floor. A similar type of floor may also have existed in **B855** and both of these may indicate a precursor, in form at least, to the type 4 cement floors seen in period 3b buildings at *Kissonerga*. The similarity of the two floors, in **B1547** and **B855**, to the layout in the building model, KM 1446, suggests that this type of floor may have been painted or, more correctly ,stained red with natural ochres. The survival of such colouring would not necessarily survive prolonged burial and may only be detectable through laboratory examination.

Type 3

By period 3b at *Kissonerga* the production of a true lime plaster on a large scale had been achieved creating a material which was used extensively in building construction. Thick plaster skims up to 0.06m thick were applied directly to type 1 earth floors often in one process with the plastering of walls creating a continuous smooth plaster surface. This is most clearly seen in **B2** floor 131 (fig. 19-20), the N floor area in **B4** (fig. 23) and floor 968 in **B206** (fig. 21-22) which retains its red colouring. These floors are of a high quality with great durability unlike the type of whitish havara/plaster skim associated with type 2 floors. It is likely that the type 3 floor is restricted to period 3b and represents the use of a new material, plaster, with its more elaborate manufacturing and constructional process which had its floruit during that period.

Type 4

By far the most sophisticated type of flooring emerged during period 3b with the construction of solid cement-like floors sitting on a cobbled foundation and bounded by two radial divisions. The methods by which this material was created are discussed elsewhere (see 4.2 below) and are confirmed by the analysis of one of these floors (see appendix 4). The development of a limited version of the full lime plaster making cycle can be demonstrated for this period and is most eloquently expressed in these floors. Sited to the right upon entering the building in the SE quadrants, the floor forms a level hard platform and, like the type 3 plaster floors, was constructed in one episode with the plaster on the walls. This most clearly demonstrated by the upper surface of the floor which is frequently seen to curve upwards at the edge to become the wall plaster. Founded on a bed of fist sized cobbles, some of which are partially calcined limestone chunks, the calcined plaster powder and uncalcined limestone mix is laid to a depth of 0.05-0.10m giving a total depth for the floor of 0.20m. Floor 291 of **B4** is unusual in that the cobble foundation is itself set in a bed or layer of white plaster 0.05m thick with a harder, greyer plaster overlying the cobbles. Levelling, or floating, of the plaster mix while wet has created the characteristic layering effect seen in section with the finer sediments rising to the surface to form a compact pure plaster layer and coarser materials sinking to bind with the cobbled foundation. Post excavation erosion has , in most cases at *Kissonerga*, destroyed the fine upper layer resulting in its removal through erosion and the exposure of the upper part of the cobbled aggregate and coarser sediment matrix giving a roughened appearance to the floor. Its condition in antiquity would have been of a smooth hard surface judging by the fragments preserved when first exposed in excavation.

The three major MChal 3b structures at *Kissonerga,* **B2**, **B4** and **B206** (fig. 19-22) as well as the exposed part of **B1103** all boast floors of this type constructed in the same fashion and located in the same sector of the building. Radial divisions of varying types were located along the edge of each floor with provision being made at the apex of the floor, in the building's central position, for some large element, presumably a hearth. Similar floors and arrangements were also located in **B1** and **B4** the MChal period 3a buildings at *Lemba.* No such floor was recorded at *Erimi.* Of interest, in this respect, is the floor arrangements in the *Kissonerga* period 3a building, **B1016**. The pattern of two radial ridges, 1522 and 1524, with a square central hearth has also been noted in other period 3a buildings (fig. 17-18). However, the densely packed area of cobbling, 1519 and 1523, within the area bounded by the ridges is suggestive of the cobble foundation in a type 4 floor and may indicate an earlier, but never completed, example of this type or floor.

Type 5

Cobbled surfaces have been recorded in various structures at *Kissonerga.* Apart from the **B1016** example, which as discussed above, which may be incomplete, there are three other instances of such a surfacing technique. In period 3 the area bounded by **B2**, **B1161** and **B1328** is packed closely with large well laid boulders and stones with, in patches, a covering of gravel and earth. A further exterior cobbled surface was also located in period 4 within the collapsed walls of **B3** forming a roughly cobbled courtyard area around **B86**. Also from period 4 is the floor of large flat paving slabs, 390, laid inside **B200**. This consisted of a single course of large, mainly limestone blocks fitted closely together and packed with smaller stones and cobbles in the intervening gaps. Fragments of querns, rubbers and other artefacts were incorporated as building material during the construction of this floor. Fine silts from between the stones indicate a dry stone method of construction with stones being carefully chosen to level up the underlying ground surface which slopes to the S.

Wall Finish

The construction of walls either in mud or in mud and stone exposes a building to the potentially devastating effects of the elements; wind, temperature change, and, most especially, water.

Any builder constructing in this manner must take account of these destructive forces and protect the external surfaces of the walls. Internally, the constant effects of humidity changes, drying and temperature fluctuations would create a continuous and pervasive flow of finer materials off the walls to the irritation of the inhabitants and the ultimate decay of the wall itself. The application of a "sacrificial" layer onto the wall surfaces is the most common solution to this problem and one which was readily adopted in Chalcolithic building construction.

Recent experimental work at the LEV into the production and use of lime based plasters in prehistory has considerably increased our awareness and understanding of this material (see 4.2). It has become apparent that the term plaster has, in the past, been used to describe a variety of materials ranging from white soil (havara/clay) to true lime plaster. There has also been a confusion between the substance, plaster and the activity of plastering, the latter of which could involve any number of materials. Sadly, this means that much explicit information about the exact nature of the wall finish in some buildings is now lost. For the purposes of this report and for future usage the word plaster can only mean a true lime based plaster. Its characteristics are a hardness and durability as well as the presence in the binding matrix of pure calcined limestone. Uncalcined, pulverised limestone and possibly kafkalla are also known to have been included as an aggregate and are recognisable by the presence of foraminifera microfossils which do not survive the complete calcination, or burning of limestones. All other materials used in wall finishes lack these features and are basically mud or clay mixes. These are referred to as renders.

Type 1

Mud created from carefully selected earths of a low clay content and mixed with a range of organic materials can provide a very durable, easily applied and weather proof finish to a wall (see 4.2). Tradition in Cyprus dictates the use of red soils (terra rosa) for wall render with the white soil (havarra: decayed limestone and clay) being reserved for roofing (Ionas 1988, 141). However, this has evolved from a very long history of building in mud and may not necessarily reflect the cultural preferences or experience of past peoples. It does highlight the vulnerability of this type of material to complete decomposition and the difficulty with which it could be detected in excavation. The archaeological evidence for mud render on a wall can survive but will only be noted with experience, patience and skill.

In a number of instances at *Kissonerga* surface renders to the interior and exterior wall faces of some of the buildings are noted and described as being "plaster". The majority of these cases cannot be confirmed as being true lime plaster and it must be assumed that some sort of havara/soil/ground kafkalla mix was used. The interior N wall of **B994** is a good example of this in which a stretch of white clay like material adhered to the surface and was in places only perceptibly different from the basic mud structure of the wall. Further evidence also exists in **B855** where a patch of reddish coloured mud, 972 was found still adhering to the inner face of the wall and may represent the remnants of a mud render.

At *Lemba*, the interior wall face of building **B3** was coated in what is described as a "mud plaster c. 0.14m thick" and similarly in **B7** where it is 0.10m thick. A true plaster of these thickness would have a cement-like quality and would be described as such. It is more reasonable to conclude that these represent a wall rendering technique using white soil.

Type 2

By far the most recognisable type of wall finish involves the use of plaster in some form. Its application over an initial surfacing of mud render is attested in **B206**, 195, where numerous episodes of replastering can be seen (see sample S153). The total thickness of the render and plaster is c20.0-35.0mm with the plaster being applied in fairly thin coats of 2.0mm. The effect of plastering onto a prepared mud surface is to decrease the amount of plaster needed and to smooth out any irregularities in the wall face using a more readily available material, mud. In the case of **B206** the various layers of plaster were both of a distinct pink and a white colour suggesting that wall decoration was a feature of this building at least. The fragmentary stretch of wall in **B493** tells a similar story with two episodes of replastering being recorded onto an initial mud render giving a final thickness of 0.10m. In this case, the plaster was not painted but was left white. It is not known whether the replastering represents a total refurbishment of the interior of the building or a repair to damaged areas. The interior wall of **B1165** also appears to have been completed in this fashion. The earliest occurrence of this comes from the period 3a buildings at *Lemba* Area I where fragments of plaster were recovered from the collapse or eroded debris of several buildings. In **B5** the excavator describes walls coated with mud, bentonitic clay and "a lime based plaster". This clear separation of different types of material does indeed argue for careful surface preparation and finishing with a very distinct lime plaster. There is even evidence from some of the fragments that the walls were subsequently painted red: whether with a decorated pattern or in monochrome is unknown (*LAP* 1, 21).

Type 3

Plaster applied directly to the surface of a wall is the most commonly reported type of wall finish and has been recorded at both *Lemba* and *Kissonerga* from all periods where structural remains exist. However, a word of caution has already been sounded about the use of the term "plaster" where a white soil or havara inclusion gives the effect of a plaster surface. The strict usage implies an industrial process of lime plaster production giving a white paste which can be applied in thin (0.01-0.03m) hard, durable layers. Accordingly, the word render or clay/havara plaster will be used.

There are numerous instances of clay render applied directly to a wall from periods 3 and 4 at *Kissonerga*. The most striking example of this comes from the interior wall face of **B3**, 737 in which a fairly thin (0.02m) coating of clay has been smoothed over a rough stone wall giving a fine, but irregular, surface through which the underlying stonework was always evident (fig 31-33). This wall is unique in being preserved to such a height giving the clearest impression of the plastered interior wall of a Chalcolithic building. Similar, though much scrappier, examples come from **B1** where the clay is applied directly to the mud structure of the wall, and from **B834**, **B98**, **B1295**, **B1547** and **B1103**. On the latter this occurs as a small area of plastering still preserved on the exterior wall face.

Type 4

In many buildings, rickles of stones or small banks of earth are frequently seen at the base of the interior wall face. This is exemplified in **B1046** where it is preserved around the entire circuit of the wall (fig. 35). It is also recorded, to a lesser degree, in **B1295** along it's N wall, **B1000** at its NW corner, **B994** along the SE arc, **B1565** and **B1103** between the floor and wall base and **B834**. Enough examples of this survive to a sufficient degree of preservation to indicate that it is part of the interface between the wall finish and the floor surface giving a broader and firmer support to the plaster or render.

In one building, **B1016**, a more elaborate form of revetment was recorded. Flat limestone slabs, some roughly worked, ranging form 0.08-0.32m in length and of varying height, were set on edge, angled along the base of the wall to form a rough sort of "skirting" which was then plastered over (fig. 17-18). No other example of this type of arrangement has been recorded.

Hearth/Oven /Fireplace

One of the most distinguishing features of the Chalcolithic house was the presence , usually at the centre of the building ,of a hearth. It would be wrong to assume that these were used primarily either for cooking or for heating although recent experimental work (see 4.2 below) has demonstrated their suitability for both functions. Past misconceptions about the purpose of these fixtures, as the bases for central roof supports (Dikaios 1936, 14), have been held until fairly recently (Bolger 1988, 28) but are now known to be incorrect (*LAP* 1, 227). Careful examination of hearth types 3-4 from *Lemba* and *Kissonerga* has confirmed the presence of ashy deposits in and around the hearth as well as a bluish tint on the exterior surface of the plaster and, in section, a reddening and light vitrification around the "bowl" consistent with its use as hearth . The fragility of the structure of many of these features also precludes their use in supporting a heavy upright timber and a weighty roof.

Five types of installation have been identified which fulfil the criteria of a hearth. In general these are to be found either inside or in close association with buildings, and are regarded as being of a domestic nature for low intensity use with a fairly low heat capacity. Obviously, there are other fire installations fulfilling the needs of more intense or specialised pyro-technical functions. Pottery making, lime burning and smelting processes as well as large scale cooking or sauna (?) activities would require installations of a different nature and are not included in this section. Some of the pits with which fire was clearly associated may satisfy the needs of a few of these activities. Here, only the domestic fixtures are to be considered.

Type 1

A ring of stones containing an area with burnt material and ash is one of the most basic types of hearths. So far, this has been identified with certainty in only one instance, in **B3.1a** at *Lemba* in which two such fireplaces, F1 and F2 were located in the NE quadrant of the building partially overlying an earlier type 3 hearth, F3 (*LAP* 1, 120, Fig. 25). Both consisted of a rough platform of sherds embedded in ash and surrounded by ring of small irregular limestone blocks with a gap left in the circle. At *Kissonerga*, **B200** contained a centrally positioned setting of stones with a diameter of 1.0m and set on edge on the paved floor of the building. No ash or burning was associated with this feature and its status as a hearth or fireplace is in doubt. Similar hearth types were also uncovered at *Erimi*, particularly in the annexe of Hut VI A.. The circular mud and stone bank infilled with carbonised material in Hut IX A may be another candidate but may equally be a much denuded type 3 platform hearth.

Type 2

A shallow pit with a hemispherical profile and lined with either lime or havara plaster showing signs of fire staining constituted a second, though uncommon, type of fire setting. A small example, F14 in **B7**, has been recorded at *Lemba* on the basis of a reddening of the "plaster" lining. At *Kissonerga* little clear evidence for this type of has been forthcoming with possible exception of **B1547** in which a large plaster lined pit (dia. c.1.12m) is sunk centrally in the building truncating the two radial ridges (fig. 15-16). Contemporary with the use of the building, its position in relation to floor 1546 and to the ridges is suggestive of a hearth. However, no ash or burning was detected and the existence of a possible type 3 hearth, 1604, to the north makes its status more enigmatic. Hearths 618 in **B376** and 1390 in **B1044** were both badly damaged by the construction of type 3 hearths directly on top of them, presumably during the refurbishment of the buildings. Both appear to be shallow scoops lined with plaster or clay although the amount of damage makes final identification difficult. In disturbed deposits over **B206** a shallow plaster lined hollow filled with ash and charcoal, 843, was found sitting on a fragmentary surface 842.

Type 3

By far the most common type of hearth and one which could almost be regarded as the hallmark of Chalcolithic domestic arrangements is the circular platform hearth with a small central firebowl. These are found in periods 3-4 at *Lemba*, periods 3-4 at *Kissonerga* and levels VI-XIII at *Erimi* where Dikaios refers to them as "central supports". It also appears to be the hearth type in Huts II-V at *Kythrea*. The quality of the construction varies considerably between buildings ranging from a small slightly domed structure with a shallow firebowl to larger, more regularly formed platforms with bevelled edges, a flat top and well formed, occasionally deep, firebowls.

The construction of these fixtures follows a fairly standard format at both *Lemba* and *Kissonerga*. A bed of stones set in mud sits in a roughly circular, shallow pit, the mud being formed into the basic shape of the hearth. The stones are fist sized cobbles, sometimes fire-cracked, and are laid in a random fashion with no kerb or edging. In one instance, 1563 in **B1565**, three artefacts were included amongst the cobbles: KM3567-8 and a fragment of a limestone figurine, KM3602. The size of the hearths averages c. 0.75m in diameter standing c. 0.05-0.09m high. There are much larger examples, for instance 828 in **B3** which is 1.30m in diameter (fig. 31), and 1359 in **B1165** which is 1.08m although these are exceptions. The firebowl, situated, on the centre of the platform, is generally a shallow depression (c.0.25m dia. x c.0.13m deep) and has a harder surface with signs of reddening or blackening from burning. There are occasional better constructed and deeper firebowls which, along with their central position, may have given rise to the idea that they served as supports for massive timber uprights. In most cases, the hearth is finished with a layer of plaster 0.01-0.03m thick giving it a fine smooth appearance. This is generally a fairly pure lime plaster with few grits or mineral inclusions although this is not always the case. Hearth 1250 in **B834** (fig. 36) was completed with a havara clay plaster while 434 in **B736** had no final plastering at all but had been surface smoothed to give it a finer finish. In view of the difficulty of distinguishing different types of plaster from field notes alone it must be assumed that both havara and lime plaster were used equally.

Two hearths also exhibit an "apron" of plaster spread on the floor around them. In the case of 1395 in **B1165**, it was a large irregular mass projecting up to 0.60m from the base of the hearth (fig. 40), whereas 828 in **B3** was a more modest, regular affair. Holes, or depressions other than that of the firebowl, have also been noted; two in 1041 of **B1044**, and four in 1359 of **B1165**, three penetrating the apron and one the hearth itself. Their function is unknown although **B1165** was otherwise remarkable for the number of postholes penetrating its floor. Colour is frequently recorded in connection with burning, usually around the firebowl where a reddish or bluish tinge is often in evidence. However, in **B3** traces of reddish plaster were noted on the surface of the hearth 828, and in **B1165** a purple tinge was seen along the N extent of the apron. Areas of distinct red earthen flooring were also recorded close to hearth 10 in **B1** and to the N of 1588 in **B1547** beside two plaster basins, 1584 and 1604. Edge set stones, usually broken querns, set in shallow pits have been discussed under doorway arrangements, but their close proximity to, and consistent association with this type of hearth should not go unnoticed. Indeed, in **B1165** the edge set quern is actually embedded in the plaster apron of the hearth.

Although most of these hearths are to be found in a roughly central position on the floor of a building, in five instances no trace of a contemporary building can be found. In two instances, 78, and 843 these come from the latest, badly eroded deposits of the site and it can be argued that their survival was dependent upon their location on the dished floors of the buildings which were low enough to escape the forces which had removed the rest of the building. However, in the example of 770 this is not the case as it was situated on an extensive surface preserved beneath **B376**.

At *Kissonerga*, it is noticeable that only three of this type of hearth; 1294 in **B1295**, 1563 in **B1565** and 1591 in **B1590** come from period 3 buildings, the rest coming from period 4. *Lemba* exhibits a much broader distribution with periods 3a and 4 being most obviously represented and the poor showing of period 3b being reflected in the meagreness of it remains. It may, therefore, be significant that period 3b at *Kissonerga* has produced only one type 3 hearth from nine fairly complete buildings.

Type 4

Similar to the type 3 hearth but distinguished from it by its size and shape is the rectangular platform hearth. Only one fairly complete example has been discovered, 951 in **B855** (fig. 24), although the existence of this type of hearth has been reinforced by its representation inside the little building model KM1446 discovered in a pit beneath **B994** (*LAP*1.2). Four other possible examples have since been identified at *Kissonerga*, each in a poor state of preservation but each, as with the building model, associated with a lime plaster floor and radial divisions so characteristic of period 3b buildings.

The hearths are all quite large being 1.50-2.20m long and 1.10-2.0m wide standing 0.05-0.11m above floor level. The best preserved, 951 in **B855**, is outlined in edging stones which are infilled with smaller stones set in mud. A carefully arranged layer of sherds set in "plaster" is laid over this with the sherds lying flat and closely spaced. A final coating of what appears from the notes to be a mud/clay plaster 0.04m thick with dense concentrations of vegetation casts finished the fixture. The remains of a small, shallow firebowl 0.30m in diameter is preserved roughly central to the surviving structure of the hearth. Discoloration of the surface mud plaster ranged from maroon around the firebowl to orange/red on the platform, due most likely to its use as a fire installation. Five or six shallow indented scoops along the W edge of the hearth appear to be integral to its construction, while from its NE corner springs the radial mud ridge 963. One further feature of interest is a small hollow 0.13m in diameter and 0.05m deep beneath the hearth which contained figurine fragment KM2086.

Four other such hearths were recovered at *Kissonerga*; 990 in **B4**, 784 and 1164 in **B206** and 1520 in **B1016**. Of these, only the latter is in any way suitably preserved to afford much information.

Its construction is similar to that in **B855** although it lacks the layer of sherds. All are associated with radially divided floor spaces. No other similar hearth has been found on a Chalcolithic site in Cyprus.

Type 5

One final type of fireplace is represented by only four examples from *Kissonerga*. Christened "tanour" by its excavator in view of its similarity to recent Middle Eastern cooking fixtures, the type 5 fireplace is found either outside buildings, in the case of 1486 and 1170 or within the occupation deposits of a building, for example, 1070 in **B1052** (fig. 36. 38) or 1275 in **B1161** (fig. 27). In general these fixtures have all been badly damaged in antiquity but all appear to conform to a constructional sequence best represented by that in **B1052**.

The tanour, to use its now common name, is set into an oval shaped pit c.0.90-1.05m x 0.85m x 0.25-0.36m. In the **B1052** example the base of the pit is filled with a layer of soil and a layer of ash upon which is founded a poorly fired, heavily gritted coarse ceramic lining 0.01-0.015m thick. A horseshoe shaped bank of stone and cobbles two courses high set in mud and with a clearly finished surface, open towards the doorway of the building is set over the ceramic lining against the edge of the pit. In no instance is there any evidence of a superstructure and in all cases the ceramic lining is badly damaged and broken.

A possible variant of this hearth type comes from the period 2 site of *Mylouthkia* where a hearth, 185, inside a timber structure, **B152** was uncovered. It consisted of a pit packed with stones and ash onto which had been laid or constructed a large, fragile CW tray, KMyl436. The base of a pointed flask, KMyl437, had then been pushed through the tray and held in position with a mud ring. The whole fixture had been heavily burnt.

Radial Floor Division

The discovery in 1988 of the ceramic model of a building, KM1446, highlighted one aspect of MChal building arrangements which had not previously been clearly recognised, and that is the formal segmentation of the floor areas of buildings by means of distinct linear divisions. These divisions are of three types and are found only in buildings of periods 1-2 at *Lemba*, period 3 at *Kissonerga* and the latest levels at *Erimi* all of which are MChal deposits. Certainly there is a marked chronological difference in the occurrence of the various types of floor division with the type 1 mud ridge appearing mainly in period 3a buildings at *Kissonerga* and its contemporary period 1 buildings at *Lemba*. It appears only once later in the period 3b building, **B855**, at *Kissonerga*. The type 2 channel and the type 3 rubble wall are found only in the later period 3b buildings at *Kissonerga* and *Lemba*. No floor divisions have been recorded in LChal period 4 at *Kissonerga* or *Lemba*.

Type 1

The earliest type of division is represented in the ceramic building model in which two low ridges radiate from the central hearth defining a quadrant of the building located on the right upon entering through the doorway. At *Kissonerga*, this type is particularly well represented with four buildings exhibiting this feature; **B855**, **B1016**, **B1547** and **B1565** (fig. 15-18, 24). It is possible that similar ridges existed in **B2** and **B4** but these have been so badly damaged as to make a clear identification problematic. They survive only as stone packed channels and it is equally possible that they may be foundations for type 3 rubble walls (fig. 19, 23). However, their insubstantial nature makes this latter proposition less likely. In **B4** a single row of fist sized cobbles defines a segment of the N extent of the ridge forming a base which would appear to be more appropriate to a low mud ridge than to a substantial wall.

The structure of the ridges in **B1016** and **B1565** are most clearly apparent and consist of a row of small cobble or fist sized stones set edge to edge on the floor of the building and covered with a mud plaster of either yellow/white havara or of a reddish/brown soil shaped to form a roughly flat topped, straight sided linear bank c.0.20m wide and c.0.10m high. These generally radiated from the centre of the building and occur in pairs running roughly NE and SE respectively. In three buildings they are associated with square type 4 hearths and spring from two of the corners of the hearth. In **B1547** the ridges splay out slightly at their intersection with wall forming a curved rather than a right angled join. The ridges in this building are also unusual in being constructed entirely in a fine, hard whitish mud plaster (probably havara or kafkalla) with no stone core. In **B1016** there are traces of a lime plaster on the sides of the ridges although whether this is from the floor plastering or not is unclear. It is not possible to present a clear cut case for the plastering of these ridges on the available evidence. It seems more probable that the material used in their construction, possibly a havara and kafkalla mix, provided a suitable durable and smooth finish obviating the need for a plaster finish.

In all cases of period 3a buildings the ridge is laid directly on one of the earlier floor surfaces of the building. Later floor surfaces are frequently seen to build up against the ridges as in **B1565** to the W outside the area defined by the ridges and in **B1016** and **B1547** to the E inside the defined area. There appears to be no build up on the other side of the ridges indicating differential treatment of the floor space inside and outside the defined area.

At *Lemba* in Area 1 there is similar evidence for the segmentation of period 3a buildings although in a cruder form than the finely shaped ridges seen at *Kissonerg*a. Four buildings; **B5.2**. **B6.3**, **B8.2** and **B9.2** all have low mud and cobble ridges radiating from the central hearth to the walls although, invariably incomplete and badly damaged. These ridges preserve no evidence of having been plastered but define shallow, scooped quadrants of plastered floor space in various sectors of the buildings. The narrow stone partitions at *Erimi* Hut XIII A probably represent similar fixtures. Hut II at *Kythrea* has a series of floor divisions of which only the stone core of roughly laid hand sized cobbles survived. These divided the floor space on the E of the building into a series of smaller compartments some of them connecting to the central hearth.

It would appear that this type of floor division, the low mud and stone ridge, was used in two very distinct ways. Both served to divide up floor space but the way in which they are used at *Kissonerga* is to define formally an area of the building to the right of the doorway upon entering. At *Lemba*, *Erimi* and *Kythrea* they are being used to describe what appear to be activity or containment areas.

Type 2

In two buildings, those of **B1** at *Lemba* (fig. 29) and **B994** at *Kissonerga* (fig. 25) a more ephemeral type of floor division was detected. Shallow grooves or channels running NE/SW from the wall of the building towards the centre occupied a position similar to the mud ridges seen in earlier buildings at *Kissonerga*. Only the NE quadrant of both buildings was preserved so the relationship of the channel to the central hearth and the possible existence of a second channel in the building is unknown.

The channel in **B1** at *Lemba* was a V or U-shaped cut 0.10m wide and 0.12m deep filled with up to three courses of pebbles and running along the N edge of a type 4 plaster floor. In **B994** at *Kissonerga* it was a much broader, shallower channel with a rough alignment of stakeholes running along its length. At the intersection of both channels with the walls of the buildings were located artefacts of major ritual significance; a limestone figurine LL54 in **B1**,(*LAP* 1), and the building model KM1446 with attendant figurines in pit 1015 in **B994** (*LAP* 2.2).

The use of a channel or groove to demarcate a distinctive floor area was also clearly noted in badly damaged deposits over **B834** at *Kissonerga* where a 2.05m stretch of channel 0.07m wide and 0.05m deep formed a linear boundary to floor 927.

Type 3

B206 at *Kissonerga*, the largest and possibly the grandest structure on that site also exhibited a floor division of a similar scale (fig. 21-22). A 2.0m stretch of type 5 walling standing 0.55m high and 0.30m thick ran from the wall of the building in a SW direction along the NW edge of the type 4 plaster floor 744. The wall was a rubble built affair with fairly regularly shaped stones and small rounded pebble gap fillers consolidated in mud and set on a mud base. The wall abuts the building wall 168 as a secondary insertion and both faces appear to have been rendered in a whitish/yellow havara plaster. There is no indication as to the original height of the wall.

The possibility that the much denuded remains of floor divisions in **B2** and **B4** are the basal courses of a type similar to that in **B206** has been mentioned above.

Basins

A total of 38 fixtures both inside and outside buildings has been located at *Kissonerga* which are grouped under the term basin. It is obvious from the range and variety of form and construction of these features that a diversity of functions is represented and that, indeed, the only unifying feature is the use of plaster, either of lime or havara, as the finishing element. In all cases the construction of the basins set into a shallow pit in the floor and, where preserved, furnished with a lip or rim suggests their use as a method of containment. The use of a finishing plaster surface would also appear to preclude any notion about their function being related to the support of structural members of the roof. Even those basins which contain a basal flat stone are also supplied with fragile plaster rims and sides which would not survive a structural function. The categories initially devised for the site of *Lemba* have here been modified. In particular, the *Lemba* types 1 and 2 no longer seem to be quite so clear cut and have been combined into a new type 1. All subsequent types have been retained but have been renumbered with the addition of one new type keeping the total number at five.

Type 1

The simplest and most common type of basin is the shallow pit lined with plaster and, usually, provided with a broad rounded lip or rim raised slightly above the level of the floor. These basins range from being little more than a slight plastered depression in the floor surface, to the larger, more conspicuous features like 103 in **B98** or the centrally placed basin in **B1547**. In all cases the depth of the basin is no greater than half the diameter of the pit in which it sits. Both havara clay and lime plaster are used to line the basins although there is no apparent pattern in the choice. They occur both inside and outside the buildings.

Type 2

The segmented basin complex is one of the more intriguing forms of plaster basin found at both *Lemba* and *Kissonerga*. A total of twelve such features have been recovered at both sites illustrating the diversity which can be seen within this type. Set in a broad shallow pit the basin is defined by narrow mud built ridges no more than 0.05m high and sometimes coated with plaster. These ridges also define segments or compartments within the basin and are arranged differently between each basin. Occasionally, as in the basins in **B1046**, the ridges are reinforced with small pebbles set into them at intervals (fig. 37, 40).

The extreme fragility of these features is emphasised by their, generally, poor state of preservation with **B1046** housing the most complete examples. The use of mud or havara plaster suggests their function to be for containment or storage and not for any heavy duty purpose. It also suggests a temporary existence for the basins as it is difficult to imagine their long term survival on the floors of buildings which, on the evidence, have experienced a degree of regular use. The modular nature of basin 1498 in **B1046** suggests alterations or additions being made either during its construction or as it was being used. The variations in floor levels between the different segments of the basin also bears this out. Other basins such as 1237 in **B855** or F1 in **B15.5** at *Lemba* appear to have been constructed in one episode with all the various segments complete. Dikaios describes in Hut IX B at *Erimi* a row of four oblong cavities 0.60m x 0.30m x 0.10m deep with rims built of clay and stones and a ridge of clay separating the third and fourth cavities (Dikaios 1936, 20). These sound to be remarkably like the basins in **B1046** although further details of their construction are not available.

Type 3

The remarkable set of basins found in **B7.3** at *Lemba* are quite unique standing in a different category from anything else on the two sites. These are a series of four heart shaped compartmented basins constructed onto the floor in mud and covered with a havara plaster. Rims define the areas of the various compartments which project on either side of an open area with rounded ends into which stones have been set (*LAP* 1, 121). They are also associated with numerous rubbers, hammerstones, querns, pestles and stone bowls.

The substantial nature of these basins standing up to 0.23m high and their good state of preservation may set them apart. Certainly, 1237 in **B855** at *Kissonerga*, a poorly preserved segmented basin, is similarly set around an open area and is associated with quern stones. It may well emerge that other examples do exist but have been so badly damaged or are so insubstantial as to make their identification difficult.

Type 4

In several instances the pit into which the basin has been set has been made deliberately deeper creating a quite different type of feature to the broad, shallow type 1 basin. Both lime plaster and havara have been used to line these basins and, in one instance, 191, provided with a slightly projecting rim. These tend to be roughly circular with diameters less than 0.50m and depths of 0.15-0.20m.

Type 5

A variation of the plaster lined pit (type 4 above) involves the lining of the pit first with stones or sherds which are then plastered over. The most elaborate example of this is 1536 in **B1016** in which fragments of a ledge footed vessel are set around a flat, pitted slab (KM3024) in the base of the pit and then plastered. An unusual version from period 5 is a plastered basin, 2129, formed from stones set at an angle in the ?middle of a stone platform 2103.

Stone Settings

Initially devised to encompass all deliberate arrangements of stones which do not conform to the layout of walls, paving, hearths, and pit or post packing, the term "stone setting" quickly became a generic and loosely applied description which included other, more clearly defined features which were preserved in a damaged or heavily eroded state. It is hoped that our understanding of these features, for example, the base of a type 4 floor, certain hearth types and floor divisions is now more extensive and will allow the identification of these features even when incomplete. It should, therefore, be possible to concentrate on defining specific arrangements of stones which are features in their own rights. To this end, it has been possible to separate out one consistent type of feature which was formerly included under stone setting but which now appears as a distinct type; that is the pier or bench. This leaves a group of other fixtures which can be more appropriately designated as stone setting.

Type 1

A ring of free standing, medium sized stones, sometimes edge-set, and occasionally including artefacts in the arrangement is one of the most frequently occurring and informal types of stone setting. These are frequently centred on large flat stones set onto the floor of the building. In many cases, particularly in the pithos building **B3**, this type of setting is associated with sherd material and occasionally the *in situ* fragments of smashed storage vessels supported within the setting (fig. 31-33). Their function as pot stands or settings is reliably confirmed by this evidence although their use for other purposes in other buildings should not be ruled out.

The characteristic feature of this type of setting is that it is built as a unconsolidated arrangement of stones set onto rather than into the floor leaving it vulnerable to damage or alteration. The accumulation of deposits around such settings, particularly where they are closely packed together as in **B3**, could lead to their partial burial effectively creating a type 4 setting. A distinction between the two could only be achieved by careful examination of the accumulated deposits and the identification of a floor surface. In **B3** the establishment of fixtures soon after the completion of the building may have prevented the formation of an identifiable floor over parts of the building whereas the dense packing of the storage vessel settings may have allowed the accumulation of materials around them creating what appears to be a mud bank. Other, free standing settings are vulnerable in a different way through the removal or dislocation of all or some of the stones possibly leaving only the flat stone base which, upon excavation would be classed as a type 3 setting. The very irregular nature of some of these fixtures suggest that this was not uncommon and, indeed, may have been part of the daily use of the building. However, it does serve as a warning that although a classification can be made, it reflects only the final abandoned state of the fixture and that this grouping may impose artificial divisions upon the material which bears little or no relation to its original structure or use and which may obscure that primary state.

Type 2

Similar to the above is the ring of upright stones bonded together with a mud mortar or plaster. At *Lemba* two examples of this were recovered set around sunken stone bowls in **B7** and **B11** (*LAP*1.1, 232). At *Kissonerga* three instances of such an arrangement were located. Over the hearth in **B1016**, and associated with the secondary use of the building, was an oval stone setting which formed the base of a mud ring. A loosely packed patch of stones stretched to the E of this . In both **B3** and **B96** a badly damaged arrangement of edge set stones lined with mud plaster and set around a flat stone were located. The similarity of this to a type 1 setting is noticeable and it may be that the use of mud mortar or plaster to consolidate the setting was quite common but has not generally survived.

Type 3

Flat stones or socketed/dished stones lying on the floors of buildings are fairly common and, in many cases, most probably reflect the process of abandonment of the structure and the dislocation or relocation of its fixtures through various processes. However, in some instances, it is apparent that the stone is still *in situ* and reflects the structural detail or use of the building. An obvious example of this is the pivot stone located inside the doorway on the left upon entering in most buildings where the entrance arrangements are still preserved.

Leaving aside pivot stones, which are dealt with under entrances, there are only six other examples of deliberate settings of flat stones from *Kissonerga*. Three of these occur in the various floors and repatchings of **B1052** in different places near or against the wall (fig. 36, 38). One, a socketed stone, KM5028, is set in a shallow plastered scoop, 1133; while the other two are set against the wall and are associated with other artefacts. A further flat stone set in a slight depression was located just inside the doorway on the right in **B3**, 2140, and is associated with stakeholes which surround it (fig. 31). This compares to a smaller stone in an identical position in **B1547** embedded into floor division 1572 and which may somehow have been associated with the doorway arrangements (fig. 15).

Only two other definite type 3 settings were recorded at *Kissonerga*, both from disturbed deposits and neither associated with a building. One, 1335, is a socketed stone; and the second, 1378, is a large quern, KM2307, sitting on a bed of loosely packed cobbles. Six other potential examples also exist of *in situ* large flat or socketed stones. Two are large stone slabs, one on the floor of **B376** in the general area of a possible entrance and the second against the S wall of **B1052**. Large socketed or dished stones, some set on or chaulked by small cobbles and pebbles, are found to the W of the entrance of **B98**, KM630; against the E wall of **B855**, KM5007; against the N wall of **B1044**; and inside **B944**, KM5065. The two large socketed stones found side by side embedded deeply in a central position in the floor of structure **B152** at *Mylouthkia* are intriguing and indicate a very long standing tradition of this arrangement stretching back beyond period 2.

Type 4

A shallow pit or hollow set with stones around its rim and occasionally provided with a low (<0.05m) earth bank is a variant of the type 1 setting in which an attempt is made to create a deeper and more secure arrangement. Almost all examples of this type of setting at *Kissonerga* come from **B3** where they are set into an earth bank at the back of the building (fig, 31). Clear evidence from some of these fixtures of *in situ* smashed storage vessels lying within the stone ring again suggest their function as being pot supports or settings. Artefacts of various kinds are to be found in and around various settings some, especially stone artefacts, being deliberately incorporated into the structure of the setting either in the ring itself or in the earth bank.

Type 5

The single edge set stone is a characteristic feature particularly of the period 4 structures at *Kissonerga*. Many of these are broken quern stones which have been set into the floor with the unbroken, thicker end facing upwards and the long axis parallel to the doorway. The example in **B1046** has been pecked and chipped on this upper surface in order to provide a flatter, but not smoother, face (fig. 37, 40). The stone is quite frequently closer to the hearth than to the doorway and, in the case of **B1165**, has been incorporated into the plaster apron surrounding the hearth itself (fig. 41). Only two period 3b buildings possess similar edge set stones, one, in **B855**, to the NW of the hearth; and the second, in **B1295**, to the SE. Unfortunately, in neither building are the doorway arrangements preserved.

The only period 3a example of an edge set stone comes from **B1547** in which a cupped stone and a flat stone are set into the floor along the floor division just in from the doorway (fig. 15-16). Only two examples of edge set stones survive from *Lemba*, in **B6.3** and **B3.1**, both of which are quern fragments set into the floor between the hearth and the doorway. These are contemporary with *Kissonerga* periods 3a and 4 respectively.

It is evident that in all cases in which the doorway and the hearth survive, the edge set stone is placed between the two and not, say, on the other side of the hearth. In a circular building all features relate directly to a centrally positioned feature and these cases are no exception. It is, however, the consistent positioning with respect to the doorway which is noteworthy and it is this relationship which is thought to be significant. A popular body of opinion amongst those excavating such features point to their usefulness in providing a brace to support a pole wedged against the door to keep it shut; a sensible and practical suggestion. However, sensible and practical suggestions are not always correct.

It does not, for example, explain the consistent choice of broken quernstones with so many other suitable stones available nor does it explain the pecking on 1686 which is set so far below the level of any in-swinging door. The need to secure the building against unwanted intrusions from animals in particular while the building is empty would also suggest that some other form of locking would need to be employed.

The two examples in **B1547** are intriguing in being the earliest examples of free standing edge set stones and in being totally unlike the others (fig. 15). It has been suggested that they too served a similar door locking function to that proposed for the edge set querns, maybe even to secure the two parts of split horse-door type of arrangement. However, this would have necessitated a double door post and pivot stone which has never been recorded at *Lemba* or at *Kissonerga*. The choice of a different type and shape of stone as well as the different location in the building sets these apart from the later edge set stones particularly from period 4. It may well be that they are an earlier example of this type of fixture but until more examples are forthcoming it may be prudent to reserve judgement.

Pier/Bench/Platform

There is a group of stone settings which are generally badly preserved and are frequently overlooked as being the collapsed or disturbed remains of more substantial fixtures such as walls. Many of these settings appear to be more structural in nature in that they are not obviously associated with moveable artefacts but are constructed on a scale and in materials which are more permanent. Their poor preservation makes it difficult to know their original height and, in most cases, to say with certainty whether they are a dry stone construction or not. Both can be demonstrated. It is also impossible to know with certainty whether these represent piers, benches or platforms or to assign any particular function to them.

Three general types can be defined based upon their relationship to the wall and other fixtures within the building. Even within these groups there are differences in construction indicating that no hard and fast rules need apply. The three types are: 1) projecting at right angles to the wall, 2) following the curve of the wall and 3) free-standing.

Type 1

The first of these has been identified in three buildings at *Kissonerga*; all of them different. The low mud and flagstone platform in **B1052** (fig. 36, 38) and the fairly roughly built squared setting in **B1016** (fig. 17-18) both appear to be largely complete with no indicators that they stood much higher. Certainly the use of flat slabs in **B1052** would appear to indicate some sort of low platform or stand. The two projecting mud and stone built stumps in **B1000** are, however, quite different and may well have stood much higher than their current condition would indicate (fig. 26). These are more like the short wall projections in **B5**, **B8** and **B9** at *Lemba*. From *Kythrea* Hut II comes a well preserved platform of stones situated to the W of the entrance immediately inside the doorway. This appears to have a kerb of larger set stones and a roughly laid cobble interior. An intriguing period 2 example comes from **B200** at *Mylouthkia* where a semi-circular low pier of mud and stones projects 0.70m from the wall at a point directly opposite the primary entrance (fig. 8, 10-11).

Type 2

Against the exterior walls of **B1547** (1550), **B1016** (1709) and also possibly **B376** to the S of their doorways are short stretches of cobble and stone built benches or piers which follow the curve of the walls (fig. 15-18). The use of mud in their construction indicates a deliberately sited and solid fixture, although the original shape and finish cannot now be identified. The consistent choice of location for these fixtures is, however, intriguing. Further examples may be represented by the group of stones and the flat slab against the SW wall of **B1052** (fig. 36. 38), similarly, outside **B1295**, and the small rickle of stones outside the NE wall of **B855**. Less convincing are the stones on either side of the entrance to **B86** and to the E of the doorway in **B834**. In two instances, **B855** and **B1016**, these piers coincide, on the exterior, with the intersection of the wall and the internal radial floor division. Whether or not these relationships are significant is a matter of conjecture but it should also be noted that, in **B206** a short stretch of wall, 147, is constructed in a similar position. However, not all buildings with radial floor divisions have external piers and not all buildings with external piers have a segmented floor space.

No definite examples of similar features have been recorded from *Lemba* although the occasional scatter of stones against the walls of certain buildings may be a clue to their existence. The *Erimi* publication drawings are less helpful in this respect and Dikaios makes no mention of such features.

Type 3

The free standing groups of stones forming rough benches or platforms inside **B4**, **B994** and **B1016** may be secondary to the original construction and use of the buildings although still part of an occupation within that building. In all cases they overlie some of the original features of the building and are often associated with other, poorly preserved, fixtures. Certainly, they are unlike the free standing pier located to the SW of the hearth in **B2** at *Lemba*. The well built rectilinear stone arrangement set in a timber frame, now burnt, and lying in the upper destruction deposits over the burnt roofing timbers of **B3** at *Kissonerga* raises many questions and promotes much speculative interpretation. Certainly it is difficult to understand its survival in such an intact state if it was indeed part of a collapsing roof or wall. It is unfortunate that more information concerning the exact nature of the deposits in which it lay was not forthcoming from the site as this would have helped to establish its original association with the building and its reuse.

Posthole/ Postsetting

Postholes are, arguably, one of the most subjective structural elements found in excavation. No objective criteria exist to validate their identification or description and, with exception of **B2** at *Lemba* where charred timbers were preserved *in situ*, it is frequently left up to the individual excavator to decide whether or not a hole is a posthole, pit, basin or animal disturbance. A reasoned view would consider a posthole to be identifiable by the relationship between depth and diameter on the assumption that such a hole would need to be considerably deeper than it is broad in order to support a post in the first place. However, this reflects a north European bias emerging from a long tradition of timber architecture and a fascination with recent African ethnography in which upright timber members were, of necessity, founded deeply in the ground in order to gain support during the construction process. Recent experimental work at *Butser* (P.J.Reynolds public lecture, Edinburgh 1991) has demonstrated not only how postholes are used but also how they can change during the lifetime of the building itself and only reach a final stable state after the building has been dismantled and abandoned. Rotting of the post *in situ* frequently leads to its collapse and the insertion of new packing material leading to a final form of the posthole which is very different from that at the initial insertion of the post. Removal or the replacement of a post in another major factor of change. Such work, as well as a long history of excavation experience has established in the European mind an ideal model of the posthole. However, this does not necessarily apply in the Middle East and there are a number of reasons to substantiate this.

In a part of the world with a very long tradition of mud architecture with flat or slightly inclined earth roofs, the timber post takes on a peripheral role and is only infrequently required as a load bearing member. Under such a building tradition posts are held in position by the weight of the roof, balcony or porch and do not have to bear the stress of the lateral thrust of a pitched roof or the unequal pressures exerted during the assembly of a timber frame. There is no need for a timber upright to be deeply founded and, indeed, it would be an advantage not to bury the bases of timber posts where they would be subject to rotting and decay at a much faster rate. A timber upright resting on the ground or supported on a flat or dished stone is a key element of recent Cypriot vernacular buildings and may, it is argued, have been a feature of prehistoric Cypriot buildings as well. From this perspective the term post-setting rather than posthole is probably more appropriate and it should be borne in mind that shallow depressions and randomly placed single flat or dished stones are as significant as the deeper, more obvious hole when interpreting building structures.

Postholes and post settings occur fairly randomly throughout *Kissonerga*, *Lemba*, *Erimi* and *Mylouthkia* both inside and outside buildings. They represent a wide range of post size, function, arrangement and method of insertion into the ground. Diameters of 0.05m - 0.25m give a broad indication that, even within the same building, different requirements are being met by the posts and it would be wrong to assume a structural function for all of them. Most postholes appear to have been constructed in the usual way by digging although, in cases, the base of the posthole was difficult to reach in excavation which suggests that this difficulty was also encountered in prehistory and that the post must, therefore, have been driven into the ground rather than being set into a pre-dug hole. The irregular or oval shape of the mouths of most holes is probably the result of the digging process as the removal of the post would have created a much greater disturbance. Experience has shown that even in a fairly dry area like Cyprus posts left in the ground for any length of time do still rot below the ground surface leaving only the upper part as a usable piece of timber. The re-use of timbers in prehistory would not always have caused damage to the shape of the hole. As mentioned above, experimental work at *Butser* has demonstrated how the continued insertion of stones and packing into the posthole to plug gaps left by a progressively rotting post to give firmer support can explain the presence of so many stones and artefacts in some postholes. This could also explain the situation where the size and quantity of packers appears to be at odds with the additional presence of a post in the same hole.

In general, the arrangements of postholes at *Kissonerga* form very few comprehensible structural elements. Certainly, individual postholes within buildings could quite happily have supported major structural elements as, for instance, in **B1565**, **B1547** (fig. 15) or **B1046** (fig. 37). However, the plethora of such features in **B1165** (fig. 41) or their insertion through a thick plaster floor in **B1103** almost defies understanding. Similarly, the rash of postholes and stakeholes outside the entrance to **B204** and **B86** may indicate a palimpsest of short term fixtures and structures (fig. 35). The area to the N of **B2** at *Lemba* also displays a similar bewildering array of posts, pits and graves, the disentanglement of which is now impossible due to the contracted time span and the shallow stratigraphy. However, certain groups of postholes do stand out as cohesive units. Around **B1** at *Kissonerga* and , similarly, **B19** at *Lemba* postholes form a distinctive mural feature. At *Kissonerga*, the range in depth and diameter suggests that more than one fixture or structural element may be represented; indeed, the group to the SE may indicate some sort of extra mural timber construction or lean-to associated with the building. A similar arc of postholes along the N and E of **B2** at *Kissonerga* may also indicate that the timber lean-to or verandah is not uncommon (fig. 19). Such a construction element, but in stone, at the aceramic Neolithic sites of *Khirokitia* and *Tenta* should be considered in this context. The arrangement of 8 posts around the entrance to **B834** at *Kissonerga* (fig. 36) is echoed outside **B2** at *Lemba* where it has been interpreted as a porch. Evidence of entirely timber constructed buildings comes from **B375**, an arc of 13 postholes set in roughly two concentric circles focused on a group of graves and a plaster platform. The unusual nature of this structure suggests that it may be unique but it does indicate that timber buildings were not unknown. A similar double walled post structure may also be represented by a set of posts, 142, also at *Kissonerga* although the possibility of it being some sort of fencing should not be ruled out. Excavations at *Maa* have uncovered a structure in which posts appear to have played a major structural role although the extremely denuded nature of the site makes an understanding of the complete building impossible (Thomas, 1988). More recently excavations at *Mylouthkia* have revealed a much better preserved structure set in a slight man made hollow with postholes around the periphery (Thomas, 1995). It may well be that similar structures exist in the lowest levels beneath **B1016** and **B1547** where period 2 hollows and postholes have been located.

One further posthole of interest is the massive stone lined setting of 1021 which may be associated with **B206**. Its careful and solid construction is echoed by a similar feature, 66, at *Maa* (Thomas 1988, 278). The association of 1021 with **B206** is intriguing and if the two do prove to be contemporary then it would be quite appropriate to view the posthole as a setting for a large timber to support the roof of such a massive structure as **B206**.

Stakeholes

Stakeholes appear with great regularity on most parts of the sites of *Lemba* and *Kissonerga* from all periods represented by *in situ* remains. Their profusion and density can, at times, lead to questions about the sanity of the inhabitants of the site. Indeed, even the origin of these features as a deliberate human act has been questioned and it must be accepted, that in some cases, a natural agency could be considered in their formation. However, it should also be recognised that many of the densest concentrations of stakeholes, for instance, outside the entrances to **B98** and **B204** where successive surfaces are preserved (fig. 35, 39), are in fact a palimpsest of several events closely spaced in time and taking place in the same area. The surfaces to the S of **B98 are** a build up of 3-4 laminated compact layers of fine silts probably deposited during the annual winter rains each one only 0.02-0.04m thick. The driving of different patterns of stakes 0.10-0.15m deep through these surfaces would result in the preservation on the lowest surface of a bewildering arrangement of stakeholes. Erosion and subsequent activity has frequently ensured that this is the only surface preserved.

The size and depth of the stakeholes varies within a limited range of 0.01-0.05m diameter x max. 0.15m deep. The frequently pristine condition of the holes themselves with smooth, straight sides and a clearly defined rim suggests that the stakes were driven rather than being dug into the ground . This places limitations on the type of material used and upon its length. The diameters of the stakeholes are usually circular or oval although, on occasion, a squared stake has been recorded indicating that some sort of preparation of the stakes had taken place before their use.

Patterns are not normally discernible in stakehole groupings although when they do occur they are quite apparent. Circular and linear arrangements are the most common as , for instance, in the surface to the S of **B98** and **B204**. In **B2** a line of several stakes appears running across the floor 131 (fig. 19). In **B994** at *Kissonerga* (fig. 25) and **B1** at *Lemba* stakes are found along the channel radiating from the centre of both buildings. Also at *Lemba* a line stakeholes was uncovered just inside the doorway to **B16**. Some sort of barrier or hurdle may be indicated from these examples. Circular arrangements around pits, for instance, to the S of **B98**, beneath the floor of **B1328** and around pit 2107 suggest some sort of setting to support a moveable object. No evidence exists to indicate what this may have been although the obvious solution of pottery or hide containers are good contenders. In several examples there is evidence from the duplication of stakeholes immediately adjacent to each other that fixtures involving stakeholes were re-established from time to time. It is apparent then that the driving of stakes into the ground of floor of a building was for a variety of purposes which is reflected in the varying and confused patterns encountered in excavation. By far the most intriguing pattern was located in the floor of **B4**. There, a collection of 65 stakeholes, some of which penetrated the solid lime plaster floor of the building, were arranged in a fan-shaped setting of vertical stakes enclosing further, smaller stakes all of which declined sharply to the SW. The purpose of this particular arrangement is a mystery which is compounded by the fact that all the stakes within the lime plaster floor must either have been inserted while the plaster was still soft or have been established before the floor was laid. Either way, the fixture contained by the stakeholes must have been a major element in **B4**.

3.3 Building Materials

The strategy of sampling and analysing materials from which the buildings uncovered at *Kissonerga* were constructed has produced an understanding about how Chalcolithic peoples exploited locally available materials and how this changed throughout the history of occupation on the site. Unfortunately the limitations of research and the constraints of excavation have not always permitted the execution of a comprehensive and thorough sampling strategy. Three conditions have led to this situation.

Many of the buildings excavated early on in the ten years during which *Kissonerga* was being excavated had already disappeared by the time this project was launched. This applies particularly to period 4 buildings in the central area of the lower terrace excavations although, fortunately, several very good structures were not revealed until the latter years of the excavation, for instance, **B834**, **B1044**, **B1046** and **B1052**. Frequently, material was kept by the various excavators involved in the LAP from structures under excavation in the hope that it would provide some further information about the building. However, no matter how good the intention, the failure to recover and record these samples within the guidelines of a programme of study has meant that many of them are now worthless. The need to understand the exact position and relationship of building materials before they can be adequately studied has meant that most samples not recovered by the author have been rejected. Period 3a buildings in the upper terrace have suffered from this problem. It also became apparent early on in the course of the present project that the excavation of structures leaving them open to many seasons of extreme weather conditions has exposed them to conditions in a way which had never occurred previously. Even an abandoned or collapsing structure is afforded some protection from the elements with the rapid build up of deposits around and in the building. Excavation removes all of this protection and subjects the walls, floors, renders and plasters to agencies which have, at times, altered the basic structure of the material itself. It was found that attempting to sample a structure after even one winter was at best futile and at worst misleading.

This, of course, has meant that much potential information has been lost. However, it is not an entirely negative situation. Enough sampling was carried out by the author during the excavation of fifteen buildings at *Kissonerga* and two at *Mylouthkia* in order to cover most building types for periods 2-4. The material from *Mylouthkia* is still in the early stages of study. Severe weather conditions towards the end of the 1994 season of excavation has meant that it was impossible to uncover and fully excavate **B200** although it is hoped that this will be rectified in the future.

Period 2

The EChal of period 2 is represented, structurally, by only one site on Cyprus, Kissonerga *Mylouthkia*. Excavations have been carried out there over a number of years by the LAP but it was not until 1994 the *in situ* building remains were uncovered. (appendix 3). The two structures from *Mylouthkia* are very different in construction to each other and both provide new insight into EChal building practices.

B200 is a fairly large building with a diameter of 6.20m and with walls standing for a height of 50.0-60.0m. The wall, 126, is unique in its form of construction (see type 7 above) which is not entirely unexpected. The floor appears to be an earth floor of some sort but, as mentioned above, difficulties in excavation have prevented its investigation thoroughly. An entrance to the S has been raised at some point in the life of the building, probably reflecting the rapid build up of steeply sloping erosion sediments against and around the building. A second entrance appears to be punched through the NW arc of the wall and may have been inserted at the time of the blocking of the original entrance. A mud and stone type 1 pier which projects from the wall for 0.70m is situated almost directly opposite the original entrance. A hearth is situated slightly off-centre to the building but, at the time of writing, has not been investigated. Baked clay with impressions of reeds lay on the floor in many fragments amongst ash and the possible remains of burnt timbers. Considerable quantities of ceramics and other artefacts also lay on the floor.

Material taken from the wall, sample S399, has a buff/brown silty fabric with a grainy structure. Coarse sands (<1.0mm) constitute about 30-40% of its bulk with larger elements comprising another 1%. Voids or air bubbles are small (<1.5mm) and form 10% of the total bulk while organic content is very low and any evidence is very poorly preserved. There are no structural lamina indicating that the clay content is also quite low. This very homogenous material has been used in the mortar of the stone part of the wall and also for the mud inner and outer render. It would appear to be a very carefully sorted soil but there has been very little other preparation in the form of the addition of organic or clay material to give it a stronger substance.

Four other pieces of structural material, samples S391, S393, S396 and S398, all come from the lowest deposits within the building immediately over the floor. All are of a dense, compact buff/orange-grey clay with few voids (c1%) and some coarser sands (<1.0mm) comprising 5-10% of the bulk of the samples. There are occasionally some organics although these are badly preserved and represent only 10% of the total sample. In one instance, the sample is 80.0mm thick. All have, impressed upon one surface, the outline of parallel bands of reeds or thick grasses (dia.5.0-6.0mm). There is no evidence of the structural alignment of the clays into laminated surfaces although each sample has been subject to some compaction with respect to their density and lack of voids. It is thought that they may have originated from the roof of the building where such conditions would prevail and where sorted but untreated earth would be used most effectively.

B152, the second structure to be unearthed at *Mylouthkia*, was much more completely excavated. It sits in a circular hollow 4.4m wide which has postholes, 147, in evidence along its S half. The interior of the structure is characterised by a low earth bank, 129, with, at its W terminal, a stone setting containing a ceramic vessel, 154, and, at its E terminal, a shallow clay plaster basin, 165. This arcs around a setting of two massive socketed stones, 186 and 187, set into the floor and, to the N of these, a type 1 hearth, 185, with a complicated history of reuse.

The interior of the structure had been packed quite closely with a fill of stones and blocks of consolidated mud, sample S392. The mud was a buff/brown compact, fine silty clay with few coarser sands but with quite a granular texture. There were some irregular voids, c.10%, and many tiny casts of the stalks of organic material, (c.2.0mm long, 10-30% of the sample). A surface was preserved but it was very weakly structured with no lamina in evidence. This may well have been the result of exposure to weathering of the material after it had been laid within the structure.

The floor of the structure had been preserved in one small patch where it seems to have subject to burning, sample S404. It was a dense orange/white clay layer 24.0mm thick and had a laminated structure at the surface which had been smoothed roughly to give an irregular finish with some burnishing. There were very few coarser sands, the bulk of the material being composed of medium to fine clay sediments and there were no organics in evidence. It had been coarsely structured parallel to the surface in thick lamina with some finer ones in evidence, all fairly weakly developed. The lamina nearest the surface was mottled with a bricky red structure, probably from burning, and a very fine slip or slurry of white clay lay on the surface itself and in the uppermost micro-cracks.

The mud ridge was constructed of a friable reddish/brown silty material, sample S243, which was loosely structured and very granular in texture. It had a low clay content, c.15-25%, appearing mainly large white clasts. Voids were quite small, 0.5-2.0mm, and comprised c.10-15% of the sample. The organic content was very low, c.1-5%, and quite poorly preserved. The surface, although roughly smoothed, was not well structured and had no evidence of laminations. This is a well sorted but poorly mixed and roughly prepared material which would not have provided a durable or finely finished fixture.

The clay basin, 165, was constructed from a fine, dense, hard brown/orange clay over 42.0mm thick, sample S403. Voids constituted c.10-20% of the sample and organics, which were very poorly preserved, another c.5%. There was a stongly structured clay lamina internally organised in vortex patterns. The surface had been smoothed to give a fairly fine regular finish creating a surface layer c.5.0mm thick of finer laminations. A very thin slip of a white clay covered the entire surface and penetrated the micro-cracks.

The packing to support the pointed vessel in the hearth was a compact, very fine orange/buff clay with some coarser sands present (<1.0mm, c.5%). There were some organics and voids but these were small, <1.0mm, and were only c.1-5% of the sample. Clasts of whiter clays were present but there were no structural laminations.

Period 3a

Two buildings have produced most of the information about structures from this period. They are both part of a group of successive rebuilding on the same part of the site in which virtually the same orientation and detail are employed. The state of preservation and detail were quite unexpected and it is fortunate that it was possible to observe some of this material before it disappeared in excavation.

B1016 is a medium sized (5.5m dia.) structure set in a shallow type 2 foundation into the gently sloping ground surface. A good stretch of type 4 wall, 1004, survives in the E third of the building and, extending in from the wall, are two type 1 floor division ridges , 1522 and 1524. They meet in the centre where the remains of a square type 4 hearth are located. The floor of the building has been preserved within the area between the ridges, 1026, and also in patches to the N of this, 1508. The wall finish in the building is curious in that it is one of the few examples of the setting of upright orthostats along the wall base, 1024, possibly to afford some protection to the more fragile wall surface, some of which has survived. A type 2 pier, 1709, lies along the SE part of the exterior wall.

Floor 1508, sample S194, is a type 1 floor founded upon the deposits exposed after the construction of the building foundation hollow. It is a 0.015m thick band of poorly consolidated silty grey/brown material with white nodules of havara and a coarse grain structure (0.5-2.0mm). It has a high clay content and poorly structured lamina indicating some orientation of the clay platelets probably through wear rather than deliberate preparation. There is some evidence of roots and insect burrows suggesting a period of exposure or abandonment. Successive phases of micro-deposition and structuring may reflect the movement and consolidation of sediments into the building by water.

Floor 1026, sample S313, is a type 2 floor which has been protected by the overlying of cobbles 1519 and 1523 in the area between the ridges. It is a deliberately prepared floor of a thin layer, 4-10mm thick, of hard white lime plaster laid directly upon the underlying earth surface. It has few inclusions (<1%) and these are small (max. 2mm dia) rounded grits. The floor has been laid in a single episode and has been roughly smoothed to give an irregular though not levelled surface.

A fragment of wall plaster, sample S315, has survived for study. It is a thin layer, 9mm thick, of a medium soft friable but compact buff/white material with no inclusions of organics or grits. There is evidence of some laminations within the structure and air holes are also present. On this evidence it is most probable that the material is some sort of clay/havara surface application to a mud render and not a true lime plaster.

B1295 is a rectilinear building lying in the N of the site. It has a type 4 wall, 1208, and sits in a very clearly defined type 3 foundation. The floor, 1301, some wall plaster, 2004, and a type 3 central hearth, 1294, all survive in fairly good condition. An entrance in the E may be indicated by the presence of an upright stone, 1694, in the floor of the building. The most significant aspect of this structure is its rectilinear shape with four rounded corners and one wall, the E wall, being bowed.

The floor of the building has been finished with a 22.0mm thick layer of a crumbly white material, possibly powdered kafkalla or a very poor lime plaster, sample <u>S307</u>. It has no organics, no internal laminated structures and no air bubbles all of which suggest lime plaster. The surface has been roughly smoothed and compacted.

A few small fragments of the wall plaster indicate the it was made of a similar material to that of the floor, sample <u>S308</u>. Again, there are no organics present, no laminations and no air bubbles. The surface has not been preserved.

B1547 is, again, a medium sized building of just under 6.0m dia. with most of its floor surface preserved, 1546, 1552, and 1578, and a good stretch of type 4 wall, 1540, lying in the E and SE part of the building. It sits in a type 1 or 2 shallow foundation hollow which has partially subsided into a series of period 2 pits beneath the building. The entrance is to the S where a plug of material, 1603/5 may be a door blocking or some sort of threshold. A pier, 1550, stretches along the SE of the exterior wall face. Two type 1 floor divisions, 1548 and 1572, extend from the SE and NE of the interior wall face converging on the centre of the building where a large lined pit, 1588, is located. A type 3 hearth, 1604, and a type 1 basin, 1584, lie to the N of the central pit.

The floor area between the two ridges, 1546, sample <u>S365</u>, is preserved for a thickness of 25-28mm. and has been formed directly onto a compact grey silty layer. The floor itself is made up of compact grey/brown silty clays with some (c.5%) small grits (c1.0mm). There is a very high proportion, c.30-50%, of the organics casts of the stalks of grasses and sedges. These have been coarsely chopped (max. length 20mm.,dia. of 1.0-2.0mm) and some of the smaller leaves have been preserved. In places the upper 10.0-15.0mm of the floor layer is a compact buff/yellow clay which forms the surface. Here, there is a much lower percentage of organics (c.10%) and almost no coarser grains. This separation into structured layers like this would be achieved by the deliberate smoothing of a mud layer while still wet in order to bring the finer clay sediments to the surface where they would form a much smoother and more regular face. It would appear that this was a type 2 prepared earth floor.

A small type 1 basin, sample <u>S368</u>, lies in floor 1546 close to the central pit, 1588. This basin has been formed in the mud make up of floor 1546 and has been lined with a 28.0mm thick layer of havara plaster containing some havara nodules (<3.0mm dia.). There is no evidence of organic inclusions or any other filler material.

A section, sample S366, preserved from ridge 1572 shows some of the details of construction of this feature. It is composed entirely of compact, fine buff/brown silts and clays with an apparently higher proportion of the clay elements. There are numerous small sub-angular pebbles (<8.0mm) and havara fragments incorporated in the material and forming about 10% of its bulk. There is a high proportion (c.30-50%) of casts of the stalks of sedges and grasses (dia. 2.0mm, 10.0-15.0mm long) as well as a further 10% voids which may also include decayed organics. The surface of the ridge has been roughly smoothed to produce, in places, finely laminated layers parallel to the surface of the ridge. A second sample, S364, from pit 1599 beneath the building is almost identical in structural detail to S366 and may also represent a part of an earlier mud ridge.

A fragment of a "bun-shaped" mud object with a rounded and smoothed upper surface and a flat rough lower surface was found on floor 1552 to the N of ridge 1548, sample S343. It is of a blocky, crumbly buff/brown silty material with c.10% coarse rounded grains 1.0-2.0mm. There are also a very few badly preserved and unidentifiable organic casts within the material. It appears to be a very roughly mixed mud of silty clay with some organic content which has largely decayed before the mixture had dried out. There is not enough preserved to indicate its original function although it may well have been part of a mud ridge or bench. The possibility that it may have been part of a rough mud brick, as has been suggested by the excavator, should not be ruled out. The storing of prepared mud over a winter season before use is common practise in the making of mud bricks and one in which most organic material decays quite thoroughly.

Period 3b

The sheer size and quality of the buildings from period 3b has ensured its status as one of the most impressive phases in the occupation of the site during which, it is thought, that technical expertise and social organisation reached a peak of excellence. By their very nature these buildings have survived the passage of time and even today present an impressive image. Despite this, it is unfortunate that most of the buildings did not produce reliable sources of sampling and study. The desire by Cypriot authorities to preserve and present an attractive archaeological attraction has meant that damaging and inappropriate conservation techniques have been applied to the site, most of it before a suitable program of sampling had been developed. However, several buildings did manage to escape this fate and it these which must supply the main core of information about the period. These are **B2**, **B206** and **B994**. Several other buildings have also been included although the incompleteness of the range of materials acquired from them diminishes their overall value.

B2 is a large (9.5m dia.) structure with almost the entire circuit of its type 3 wall preserved except for a gap in the S where an entrance would have been. It appears to have been set into a type 1-2 broad, shallow foundation hollow which has been packed along its N arc with small stones and pebbles, 388. There is a good expanse of type 3 floor, 131, in the W sector of the building and in the E is a well preserved type 4 plaster floor, 389, bounded by the remnants of what may be two type 1 floor divisions, 1074. A large pit in the centre of the building, 41-42, is probably the remains of a hearth. Very little else remains of the interior of the building despite the survival of the wall.

From within and over the stone basal courses of wall 34 comes the meagre survivals of its main structure, sample S260. A compact buff/light brown friable material of fairly fine silts appears to have comprised the upper structure of the wall and to have been the main bonding agent of the stones. It was of fine homogenous silts with few larger mineral inclusions and very few preserved fragments of the casts of organic material, the latter comprising less than 10% of its total bulk. Some tiny voids, also comprising 10% of the bulk, were probably the remains of decayed organic material and air pockets left over from the mud mixing process. Unfortunately, no surfaces were preserved so it is impossible to determine how the mud of the wall had been finished. It would appear, though, that it was built of well sorted and prepared soil which had been mixed with an organic material and allowed to mature over a period of time before being used in construction. A similar type of material was also found in small consolidated lumps lying on the floor immediately up against the inner wall face, sample S209. If this is part of the wall structure then it has fallen directly on to the floor without any intervening erosional deposits, possibly indicating that the wall of this structure collapsed suddenly. The absence of any roofing material or of water/wind eroded layers is significant.

Lying in the upper deposits of the building was a lump of material which may also be part of the wall, sample S359. It is a buff/brown clay with c 10% coarse sands (<0.09mm) and the cast of the stalks of grasses comprising about 40-50% of the total bulk of the material (2.0mm dia., 20.0mm long max.). The surface is preserved and is very finely smoothed to give a thin layer of laminated clays in which no organics show. It is unlikely that this is anything other than a fragment of mud wall. Its position within the eroded remains of the building may give us a clue as to the nature of the upper part of its wall.

The floor in the W and NW of the building, 131, is surprisingly intact, sample S249. It is a 15.0mm thick layer of compact white, dense lime plaster with some irregular pinkish/white grits of uncalcined material (<1.0mm dia). The surface is finely smoothed and, in places, burnished possibly through use. It is slightly uneven with a crazed pattern of tiny cracks and has been laid directly on to the underlying earth surface. Patches of this floor beside the pit cut by Grave 503 indicate that it may have been quite extensive covering at least half the floor area of the building. The total volume of lime plaster needed for such a floor would be $(3.14(4.75)^2 \times 0.015{=})\ 1.06\text{m}^3$.

Far more impressive is the large plaster floor, 389, lying in the E and SE of the building, sample S272-3. This is a massively built piece of flooring set on a bed of cobbles and stones, some uncalcined lumps of limestone or kafkalla. The fact that the floor has been preserved and not removed in excavation means that its total thickness and the nature of its foundations at the centre are not available to us. However, the upper layer of almost pure lime plaster is 100.0mm thick and is of a compact, dense white matrix with some small coarser sand grains. Large, angular pebbles and stones of burnt but uncalcined limestone make up 26-30% of the total bulk of the floor. It appears to have been laid in one episode and the care with which it had been laid is reflected in the absence of any lamina or air bubbles. There is a gradation of sediments and aggregate from the base of the floor to its surface with the finer material being floated to the surface. The top surface of very fine lime plaster achieved through floating while still wet has now vanished since exposure to the elements but did exist in patches when first uncovered.. Several postholes penetrate the floor mostly around its periphery; these must have been established while the floor was still wet. It is also significant that the floor does not quite reach the wall along its S arc. This is also a sector where the wall base itself makes a sudden and curious contraction and may be an indication of rebuilding at this point. The broken and very damaged nature of the edges of the floor are the result of subsidence suggesting that the plaster floor had always stood proud of the rest of the floor surface in the building.

If it is assumed that the total depth of the floor for its entire area is the same as that at the edges then it is possible to determine the volume of lime plaster used in its construction. Indications from the presence of the floor divisions suggest that the floor occupied one quarter of the total area of the building giving its volume as ($(3.14(4.50)^2 \times 0.10)/4=$) 1.5896 or 1.6m^3. Over one quarter of this is composed of aggregate giving the total volume of actual lime plaster as 1.0-1.2m^3. This is not much more than that needed for floor 131 over the N part of the building.

B4 is a large 9.0m dia. building of which only its E half survives with only the base courses of its type 3 wall, 29, set in a type 2 foundation, 1696, being preserved. The greater part of its massive type 4 plaster floor, 291, still survives although the radial floor divisions, 304 and 991 have been largely removed. The remains of what may be a square type 4 hearth, 990 lie centrally to the building. A small patch of flooring lies to the N of the main floor area. This building is remarkable for the series of stakeholes, 314, which are set into the plaster floor and into other parts of the floor and hearth.

The large floor area is a massively constructed plaster floor 200.0mm thick which is set upon a foundation of small angular cobbles and stones. The main matrix of the floor, sample S271, is a dense white lime plaster containing 30-50% small angular pebble aggregate. The traces of at least two very thin (1.5mm thick) layers of almost pure powdery plaster with c30% angular gravels were preserved on the surface of the floor and may represent the initial smoothing of the floor while still wet and possibly the application of secondary surfaces. This latter is borne out by the hard plaster lip along the wall edge of the floor against which these layers lie. The floor as a whole sits proud of the other contemporary surfaces within the building.

B206 is the largest prehistoric structure in Cyprus with an estimated diameter of over 15.0m making it one of the most impressive structures at Kissonerga. An arc of its massive type 3 wall, 168, is preserved along its E side and is set into an elaborate two step type 2 foundation cut. A large expanse of type 4 plaster floor, 744/970, survives in what would have been the SE quadrant of the building. A row of stakeholes and several postholes were set into the plaster of the floor. This is bounded on the N by a type 3 floor division, 197, which still stands 0.55m high. To the N of this floor division is a small patch of a type 3 plaster floor, 969/9, which was originally stained red or pink in colour. The walls of the building had been plastered on the interior face with a thick lime plaster which showed signs of frequent replastering, 195, and which had also been stained red a various stages of its existence. Much of the plaster had collapsed onto the floor where it had survived the collapse or destruction of the rest of the building. The remains of what may have been a large square type 4 hearth, 784/1184/1182, was situated in the centre of the building. Very little else survives from this otherwise impressive structure. The preservation of the section in which the plaster floor is located is, perhaps, significant particularly in that so many vessels were found smashed directly onto the floor without any intervening erosion deposits and in a fashion which suggests a deliberate action rather than gradual abandonment.

The stones of wall 168 are massively set with an inner and outer face and rubble core bonded with compacted mud. Over this from amongst the upper stones there still exist the traces of a structural mud, sample S253, which may indicate the nature of the rest of the structure. The mud is a fine grained, compact material with many tiny air bubbles (<10%, max. 1.0mm dia.) and the casts of the stalks of grasses (max. 2.0mm dia.) set at irregular intervals and forming about 20% of the bulk of the sample. Clasts of a white material, possibly chalk or havara, and some small pebbles (<10.0mm dia.) constitute a small proportion of the sample (<10%). This is indicative of a material which has been selected and prepared by sorting out the coarser elements and including an organic binder. The air holes are the result of a well mixed aerated clay which has set and dried preserving the air pockets.

The radial floor division, 197, was a rubble built type 5 wall with large stones projecting from one face to the other and smaller stones set into the intervening gaps. The mud mortar from this wall, sample S267, indicated that a structural mud was used in order to give greater degree of stability and cohesion. The mud was a compact buff/brown fairly homogenous silty material with some small patches of unmixed clays still in evidence. Sherds, gravels, pebbles, bone and flint occur in patches throughout. Within the mud itself there were few mineral or grit inclusions and the casts of small, fine grasses or sedges were few and very poorly preserved. The presence of unmixed clay and the absence of air pockets suggests that the soil was not thoroughly prepared before use although it does appear to have been sorted to remove the coarser elements. Occupational material also appears to have been incorporated but not thoroughly mixed with the mud. Some organic binder was employed but not in any quantity and this all appears to be indicative of the level of preparation which would be acceptable for a non-load bearing, or low, wall.

The surface of the main wall, 168, and of the radial floor division, 197, had been finished in a fairly thick, c.30.0mm., render of a whitish/yellow material with a few rounded coarser grains (<3.0mm dia.) and some casts of the stalks of grasses(?) comprising c10% of the bulk of the sample, S265. It was fairly soft and friable and not dense or compact with small air spaces making up c.10% of the sample. No surface was preserved due to the rapid erosion of the wall immediately after exposure in excavation. The colour of the material suggests a high proportion of clays although this was not evident in the structure of the render. It was, however, composed of a soil which had been sorted and mixed with organics prior to use.

Lying at the base of the wall on the floor where it had collapsed was the wall plaster which had once adorned the interior of the building, sample S153. The lime plaster had originally been applied to a thick render, 195, which still adheres to parts of the wall face. The plaster was fairly soft and grainy with a few, small (<1.0mm.) coarser grains. It had a laminated structure with distinct surfaces defining the 2.0mm thick layers which had been built up to a minimum thickness of c.20.0-35.0mm. Some of the internal layers were pink in colour with two intensities or tones being represented. These alternated with layers or bands of white plaster. The final preserved surface of the plaster was composed of several layers c0.05mm thick of a red material which had been covered with a very thin layer or wash of a yellowish/whitish clay like material. This latter wash flaked off from the red surface very easily and must have been applied while the wall plaster was still intact as it did not appear on any of the broken edges of the plaster. It would appear that the wall face in the building had been refurbished on numerous occasions with a thin lime plaster finish which was either stained pink or left pure white. This was apparent on at least 4-5 instances although it is not possible to determine if the refurbishment applied to the entire wall face or only to patches. The final coating or layer was of a much deeper red material unlike the previous layers although it too was a lime plaster. This was eventually covered *in situ* with a very thin yellow/white wash which does not appear to be lime plaster and may indeed be some sort of havara clay slip. Not enough survives to be certain but, comparisons with the final treatment of the building model, KM1446, are invited.

The massive lime plaster floor 744 is the dominant surviving element of the building. It has not been removed in excavation making it difficult to know its sub-surface structure. However, along the edges and where it has been cut by later pits this information can be obtained. The surviving depth of the floor at its edge is 100.0mm thick and it sits on a bed of angular cobbles and small stones. The upper lime plaster layer itself contains c.25% angular, reddish aggregate, sample S266. The section through the floor structure shows it to grade gradually from the cobble foundation to the upper surface where most of the finer elements have settled. The very smooth and fine surface survives in a few patches only and has been largely removed through weathering exposing the core with the larger aggregates now projecting. Analysis of the material indicates that it contained high proportions of burnt lime with coarse limestone fragments also being added (appendix 4). The lime itself contains complete and fragmentary micro-fossils indicating either incomplete calcination or the addition of marl to reduce the total amount of lime used. Assuming an overall depth of 100.0mm for the entire floor the volume of the original floor would be $((3.14(6.5)^2 \times .10)/4=)$ 3.316m^3 of which only 2.49m^3 would be actual lime plaster.

To the N of the main floor area of the building and on the other side of the radial wall was preserved a small section of the floor of another room, sample S295. This was a type 3 plaster floor laid directly upon the underlying earth surface. It is max. 21.0mm thick and has been built up in two layers, a lower one which is white and is 6.5mm thick, and an upper layer which is red/pink and is 6.5-15.0mm thick. The lower layer which, although white, has a very deep pink surface slip or wash applied to it. The upper pink layer has a concentration of pigment in a very thin band at the surface which is composed of the finer elements of the material probably brought to the surface during smoothing or floating while still wet. The material of both layers is a dense paste with tiny granular, rounded inclusions which appear as white clast in bands of denser pigments. The lower, white layer appears to be of a purer material with the pigment being applied only to its surface. The upper layer has a mottled appearance of pink, grey and white suggesting mixing of the pigment throughout the entire layer. The impression gained is of two floor surfaces being laid one on top of the other using two different methods of colouration, the first through the application of a colour wash and the second by mixing the colour throughout the plaster. They both appear to be lime plasters. It is interesting to note, that if this floor also covered one quarter of the building floor area then, due to the purity of the plaster , the total volume of the floor would be $((3.14(6.5)^2 \times .065)/4=)$ 2.16m^3 . This is not far short of the total amount used in the more impressive plaster floor 744 to its S.

From the deposits lying over and within the building come three samples; S290, S292 and S296 which may be part of the upper parts of the structure. The first two are of mud and clay havara mixed with coarse grits (0.5-1.0mm) forming <1% of the total bulk and containing a small amount of organic material. Both samples have a smoothed outer surface and an inner face which still bears the impressions of reeds and larger branches or timbers, one possibly squared. The latter sample has a similar smoothed surface and an inner face which has been moulded against some solid material possibly a stone or timber.

B994 is a medium sized structure with a diameter of 6.5m and is preserved for over half of its area with no trace of the S half surviving. It has a well constructed type 3 wall, 943, and is sitting in a shallow type 2 foundation, 1119. The wall survives as a base course only and in places appears to have been constructed entirely in mud. The floor is an earthen type 2 surface although the presence of a patch of clay may suggest that it may have had an additional clay covering or repatching. A few pits, 1202 and 1205, a stone setting, 996, a channel which may be a type 2 floor division and some scattered stake and postholes comprise the uninspiring fixtures of this structure. It will persist, however, in the annals of Cypriot archaeology for the contents of the pit, 1015, found beneath its floor and wall. This contained the remarkable building model KM1446 and its collection of figurines and other artefacts. (*LAP* 2.2).

The wall, 943, was largely constructed in stone for its foundation courses but a stretch of the N section was built in mud only, sample S181. The mud here was of a friable orange-grey silty clay with fine to coarse sand grains. It was a fairly homogenous fabric with weakly developed clay lamina appearing in places and the poorly preserved casts of the stalks of organic material constituting 1-5% of the total bulk of the sample. There was no coherent structure or orientation to the sediments and in the larger air pockets coarser material had accumulated. It would appear that this was a well sorted and prepared clay loam mud which had matured before use but had not been extensively worked *in situ*.

Adhering to the inner face of the wall and, at times barely distinguishable from it, was a facing of render which appears only on the mud section, sample S182. It was a reddish/brown compact but friable clay loam with a homogenous structure of fine sediments and a grainy texture resulting from a 10% content of small (<0.5mm) rounded grits. There were some casts of the stalks of organic material, c.1%, and a few small air holes, c.1%. On the outer surface there were lighter patches of a whitish/brown clay with some indications of structural laminations parallel to the wall face. The indications are that this was a well prepared surface render which had been sorted to remove all coarser elements and allowed to mature after being mixed with an organic binder before being rendered and smoothed onto the wall face.

The floor of the building, 983, was made from a carefully laid mud surface, sample S231. It was max. 56.0mm thick and was composed of a compact but friable reddish/brown homogenous material with many small (<1.0-2.0mm) rounded coarser sediments and mollusc shells comprising <10% of the bulk of the sample. Air spaces also formed 10% of the material. There were a few badly preserved casts of the stalks of organic material throughout the sample (<1%) with none impressed into the surface. The floor surface itself was smooth and compacted but showed no signs of lamination or structural alignments. The colour of the sample and the lack of structural clay laminations suggest that the clay content of the material used in the floor was quite low. It had, however, been made from a carefully sorted and prepared soil which had been allowed to mature with some organic binder. The presence of tiny air pockets suggests that it was well mixed but had not been beaten or compacted when laid. The absence of a thick and well defined layer of compaction at the surface also bears this out. A lump of whitish, poorly sorted and weakly structured havara clay lying over this floor surface may be an indication of later surfacing, sample S183.

From within the post-occupation deposits of the building comes a consolidated lump of a compact, hard but lightweight material, sample S184. It is grey/buff in colour with a blackening towards the surface although the surface itself is a buff colour. It has a homogenous matrix with many small (<2.0mm) rounded coarser grains, some casts of organic material and many tiny air holes. The surface which is preserved is roughly smoothed and still bears the striations of the material used to carry out the smoothing. It is also angled as if from a corner. The meaning of this material is not at all clear and its position within the structure may not be of any significance, but, it is structural and it most likely came from the upper part of a building, maybe as part of the roof lining or a detail from the upper wall head.

Three other structures provided information of building materials and methods of their use from this period. In **B855** a section of the wall finishing was preserved applied to the inner wall face, sample S379. It consisted of a 14.0mm thick layer of a compact grey render with red clasts and many small irregular flecks constituting 10% of the sample. There were many tiny air holes and the casts of the stalks of grasses, not finely cut and with diameters of c. 1.0mm (20%). In one instance the fossilised stalk itself was preserved. Over the surface of this render was spread a 7.0mm thick layer of a havara plaster which in places was applied only as a thin, <1.0mm thick, skim. It was a compact buff/white matrix with some grits and, occasionally, white flecks (<10%). There were some small air holes and the surface was smoothed and had a laminated structure parallel to the surface.

The solid plaster floor, 1192, of **B1103** was of a dense hard lime plaster 320.-52mm thick, sample S280. It contained many (30-50%) small to medium sized aggregate inclusions of rounded and angular limestone chunks as well as some burnt but uncalcined material. The surface was smoothed but irregular and bumpy indicating the loss of the original finer plaster finish.

B1328 is very poorly preserved but a section of its floor surface, 292, does survive, sample S282. This is a soft, white, crumbly havara clay 43.0mm thick which is founded directly on the ground surface. It has c. 15% coarse rounded grains (2.0-3.0mm) and no evidence of any organic material. The surface is very poorly preserved and quite soft.

Period 4

Period 4, the LChal period, is the last major phase of occupation on the site at *Kissonerga* and it signals the end of the Chalcolithic period proper. Subsequent activity has been detected on the site but it is very localised and contains no *in situ* structural deposits. The pattern of occupation and the nature of the buildings during the LChal are substantially different from that of preceding phases reflecting dramatic changes within society at that time. However, the expertise of the LChal peoples and their ability to exploit and manipulate resources and materials is not diminished; what has changed is the way in which these materials are used. The problems involved in obtaining material for study from this period have been mentioned above and it is unfortunate that so little was available for study. However, two buildings stand out for their state of preservation and for the opportunities they afforded the programme of material sampling and study. These are **B3** and **B834**. Several other structures have been included within this study although the sampling within them was, of necessity, incomplete and opportunistic.

B3 is one of the most remarkable and best preserved structures to have survived from prehistoric Cyprus. It is a large 9.0m diameter building with a substantial type 4 wall, 46, preserved for its entire extent, 50.0-60.0m wide and standing over 0.80m high. A massively constructed type 2 foundation cut terraces the building on its N half into the steeply sloping hillside. An entrance with all the type 3 arrangements and a stone threshold is located at the S of the building and in the centre is a large and very well preserved type 3 hearth, 828. The floor is a type 2 earth floor and the interior surfaces of the walls have been finished in a type 3 havara plaster, 737. This building is distinguished both by its state of preservation and by the large amount of cultural material found lying inside it including 40 storage vessels, numerous smaller vessels, a large stone mortar, and large numbers of smaller artefacts lying scattered over the floor. Burnt timbers and baked earth lying over this material may represent the collapsed roof of the building although subsequent reuse of the structure has obscured some of this evidence.

The floor of the building, 695, is a 25.0mm thick layer of fine grey/brown sediments with some small (4.0-5.0mm) rounded grits, sample S279. There are consolidated lumps of whitish clay with indications of internal structural laminations. Many tiny air holes constitute <5% of the sample and there are also the very poorly preserved casts of the stalks of organic material although these are difficult to distinguish and do not constitute any significant percentage. It is difficult to characterise this type of sample as it could so easily have been derived from any number processes. The presence of clasts of clay as well organic material indicates that some sort of preparation has taken place but it should be noted that this may have been for some other purpose other than flooring and that what is being seen here may well be the debris from that process left on the floor. The fact that it is in an identifiable layer which does not grade into the underlying deposits and also that there are air spaces present suggests that this surface may have been deliberately laid from readily available but not specifically prepared material.

The central hearth, 828, has been finished in a crumbly, white lime plaster with a high percentage of coarser elements of sand and white nodules (c.30%). There are no organics, no lamina and very few air bubbles. The surface has been very roughly smoothed but not enough to float out the finer elements of the plaster to give a finer finish, sample S306.

The interior wall of the building had been finished in a fine havara plaster, 737, which had been applied directly to the stonework of the wall with no preliminary render, samples S174 and S332. The havara plaster was 6.0mm thick at its maximum and had been applied in three distinct layers, probably the result of replastering. It is a whitish/yellow fine, well sorted clay with a distinct laminated structure orientated parallel to the surface of the wall. The organic content was fairly low being only 10%. The surface had been very clearly smoothed and, in places, burnished to give a fine smooth finish. A similar sample, S14, was found in the debris inside the building. It was identical to the plaster on the wall but had a much higher and more distinct organic content (20%). It also had very clear structural laminations parallel to surface which had been highly burnished but which was also showing signs of exfoliation.

Six samples from the debris lying immediately on the floor of the building and from within and around the storage vessels are of a different type to that already seen from the building. These are S147, S276, S287, S291, S335 and S382. All are of a dense black/grey- buff/orange silty material with a high percentage of clays and with some (10%) coarser sands and gritty material. The clay and silts have been well mixed but the presence of the clay is detectable by the strong internal structural laminations. There is also a fairly high organic content with 30-50% being represented by the casts of the stalks of grasses. Air bubbles also form about 10% of the bulk of the sample. The internal structure of the material appears to be chaotic with no consistent orientation of the clay lamina and no specific surface smoothing in evidence. All samples have been burnt and baked. All are also characterised by the impression of reeds and grasses preserved on their surfaces. These surfaces are quite distinct and appear on one side of the sample only but often incorporate the shapes of larger objects in the form of right angles and facets on the impressed faces. These samples are all carefully prepared and sorted mud which has been applied roughly to a structure composed of reeds with an underlying formation of larger elements, possibly timbers. In only one instance was there any evidence that the mud had been smoothed in any fashion. Their position lying burnt on the floor of building which had itself been burnt strongly suggests some connection with its roofing.

B834 is a medium sized building with a diameter of 5.5m and a type 4 wall, 858, which survives for most of its circumference apart from a gap in the N where it has been destroyed by a later pit. The wall stands c.40.0m high and has been finished on its internal face with a type 3 havara plaster applied directly to wall face, 1270. The floor, 1228, described as a "white plaster", is more likely to be a type 3 havara plaster floor and shows evidence of having been relaid or repatched on several occasions. In one instance a figurine, KM2165, had been incorporated in the repatching. A circular type 3 hearth, 1250, was centrally positioned to the building. The entrance, 1254, opened to the SE and was provided with the classic type 3 arrangements with stone threshold, pivot stone and edge set quern stone. A surface with postholes lying outside the entrance may represent some form of porch or enclosure. Internally, very little else was present. A series of deposits within the building have been interpreted as the re-occupation of the structure in some form with several floors and deposits building up to the top of the surviving wall head. The evidence for this is contentious.

The wall, 858, which is largely stone built produced a very fine grained silty material with c.10% air bubbles and very few casts of organic material being preserved. There were some fragments of shell (<1.0mm) and a few small pebbles (1.0-20.mm), sample S269. This would be in keeping with a mud mortar which must be sorted in order that the stone work sits well, but which would not require much or any organic binder.

The hearth, 1250, was constructed from a mixed material of a compact grey ashy silt with clasts of a white/yellow clay, sample S270. It appears to have been roughly sorted with some small (<1.0mm) rounded coarse sands. There were many tiny air bubbles and some casts of the stalks and one grain husk of a grass binder. The surface had been well smoothed. The firebowl was of a purer, crumbly white/yellow clay in which the casts of the stalks of the organic binder was evident. The surface of the firebowl had been smoothed and burnished to a very fine finish. The whole structure is most likely to have been constructed from a havara clay mud which has baked into the fine hard material that survives.

No sample of the floor was obtained due to damage and erosion over several seasons. However, several examples of the wall plaster were obtained which, on comparison to other buildings, is usually composed of the same sort of material. The wall finish was a layer of havara clay plaster up to 28.0mm thick which had been applied directly to the wall face, samples S207 , S268, S284 and S298. It was a dense, very fine white-grey clay with very few coarser sand or grit inclusions. The sample which came directly from the wall, S268, had quite a low percentage of organic casts while the sample which came from the floor of the building, S207, had 30-40% of its bulk formed from the casts of the large (max. 3.0mm. dia.) stalks of a grass binder. In both cases the surface had been smoothed and the structural lamination of the clays was evident although weakly so in sample S268. One example of plaster from this building, S284, is a small fragment (30. x 45.0mm) which appears to have some sort of painted decoration on its surface. Several bands 3.0mm wide of a red/black pigment or slip are faintly preserved on the sample. Its significance is unknown as this sample was found in deposits overlying the floor and cannot be related to any particular part of the wall.

Two further samples from within deposits lying directly over the floor of the building may give some clue about the form of the upper structure or roof, samples S178 and S193. These are both burnt compact, fine clay layers with large coarse sands (<3.0mm) comprising 5-10% of the sample and with air bubbles comprising another 10-20%. There is quite a high proportion of organic material, 15-20% in S178 and 30-50% in S193, preserved as the casts of stalks of grasses (2.0-3.0mm dia., c.10.0mm long) which are randomly organised throughout the sample. The surfaces of both samples have been well smoothed and the clays have been structured in many layers of fine, clear lamina orientated to a depth of 5.0-8.0mm parallel to the surface. This is apparently a finely prepared clay render which has been applied to some surface within the building. The fact that they are burnt and lying on the floor suggests they may be associated with the roof.

These last five samples come from within 1138 which lies directly on the floor of the building and constitutes the primary deposit associated with the initial abandonment of the building, sample S203. It is a compact, blocky but friable grey/brown silty material which is fairly homogenous with few coarser sands (<3.0mm) which constitute <1% of the sample. There are many tiny air holes comprising 10% of the sample and no evidence of any organic material. The fineness of the sediments and the presence of air holes suggest a natural, gradual process of deposition with very little compaction through use.

A similar deposit, 1125, overlies this and consists of a compact, fine, grey/brown silty material with pockets of grainy sediments, sample S201. There are many small to medium coarser sands (<3.0mm) comprising c10% of the total bulk of the sample, clasts of denser material and many tiny air holes again comprising c10% of the total bulk. There is no evidence of organic material. The upper surface of this material has been structured into a compacted clay surface, sample S177. The clays are a buff/cream friable material 7.0mm thick and strongly structured to give clear lamina orientated parallel to the surface which is roughly smoothed. Insect burrows penetrate the layer. This entire deposit could also be a natural formation. The slightly coarser, pocketed nature of the deposit suggests fragments of more consolidated material being included in it make up, whether by design or through the collapse of the upper parts of the building is unknown. The clay surface founded upon it may also be a natural event; the absence of any organics suggest the restructuring of the clays within the deposit through water sorting. This, and its colonisation by burrowing insects, is more likely to have occurred if the entire deposit was completely exposed to weathering; in other words, the roof of the building had by this stage vanished.

This was followed by three layers of unconsolidated ashy silts, 1090, 1082 and 1069. Between the latter two layers was a surface which shows evidence of having been deliberately constructed, sample S176. It is a thin, 5.0mm, havara plaster surface which has been laid over a mud base of grey/black silts containing large, irregularly positioned casts of the stalks of grasses comprising 20% of the sample.

Over the entire building was a crumbly, friable, reddish/brown clay layer, 1061, which was neither compacted nor consolidated, sample S170 and S199. It was a poorly sorted, weakly structured material with c50% coarser sands and clasts of denser clays and chalk or limestone. It does not appear to have been sorted or prepared in any way, neither does it appear to have existed as an open, used surface.

Four other buildings from period 4 have provided some information about the use of materials and construction processes. From **B1165** come two samples of plaster from the floor and from the wall, samples S300 and S302. Both are fairly thin, 10.0mm, layers of a poorly sorted whitish clay with a loosely structured slightly grainy appearance. Coarser sand clasts are in evidence and the surface, where preserved, has been very roughly smoothed. A plaster basin, 1386, from secondary levels in **B1046** was constructed from lime plaster in two layers, sample S250. The lower layer is a 20.0mm thick knobbly and very poorly laid base supporting an upper layer of white lime plaster containing large nodules of partly calcined material (10.0-35.0mm) comprising 15-20% of the total bulk of the sample. The surface of the basin is a grey matrix of fine grains (<0.5mm) comprising 30-50% of the material which are bound by a very fine orange-grey plaster. This appears to be a roughly constructed basin or hearth which has most probably been subjected to burning. The hearth, 1209, in **B1044** has been constructed from a friable, crumbly orange-white clay with a blocky internal structure, sample S227. The clay lamina are weakly developed and the blocky clasts are randomly organised with c10% voids. There are few coarse sands and no organic content. This appears to be a very roughly finished structure made from a very poorly prepared clay material. Finally, the earth floor in **B1** is a 35.0mm thick layer of homogenous buff-reddish/brown silts with a few coarser sands (<5%) which are clear/white angular quartzite grains, sample S297. There are also tiny air holes present (<5%) but no organic material. The upper surface is very finely smoothed and, in places, stained with a red pigment. This may well be a deliberately prepared surface but there is not enough evidence to be conclusive. The effects seen could equally arise from the compaction and structuring of the surface elements through use.

3.4 The Building Model, KM1446

Discovery and Context

The discovery in September 1987 of the exceptional cache of some fifty objects in a pit, 1015, beneath the wall and floor of **B994** is one the most exciting events in the annals of Cypriot prehistoric archaeology. Its publication in 1990 has brought this remarkable find to the attention of the archaeological community (*LAP* 2.2, 1990), and the decision to exhibit it with pride of place in the Cyprus Museum is ample testimony to its importance and ability to capture the imagination of the public. The fifty figurines and other artefacts were largely contained within a ceramic vessel, KM1446, which is in the form of a model of a building and, as such, is unique in the archaeology of the Erimi Culture. The figurines and accompanying entourage have provided a fascinating field of study and have opened up new avenues of study into the early representational art of Cyprus and have provided a brief, but tantalising, glimpse of early communal ritual behaviour. It is not the intention here to examine the significance of the figurines, that has been dealt with in publication. However, the vessel itself is a representation of a MChal building and should have some bearing on any study of prehistoric architecture and of behaviour associated with buildings.

The circumstances of discovery of the cache have been described in publication (*LAP* 2.2) as have most of the details of the artefacts and associated vessels. The vessel which is the building model has been discussed by Bolger within the context of the ceramic traditions of the MChal period 3b where she establishes its credentials as a product of the repertoire of known traditions from that period. The character of the decoration is, however, unique to the vessel and must be considered to relate to that which it represents, and that is, a building. This has been assessed by both Bolger and Peltenburg who consider it to be too schematic to be understood.

The bowl was found in a pit, 1015, beneath the floor of **B994** which also partially underlay the wall of the building. The building was constructed in a broad shallow type 2 foundation hollow, 1119, into the base of which the pit 1015 and 1225 had been dug. Burnt material and heat cracked stones which were used to fill the two pits indicate other activities taking place in association with the deposition of the contents of these two pits. Evidence that **B994** was constructed immediately upon completion of the depositions within the two pits comes from the fact that the wall stones of 943 were laid directly onto the rims of the stack of vessels in 1225 without any intermediate lenses or layers of soil build-up; and from the gap between the base of the wall and the upper contents of 1015. This indicates that the wall must have been built and its mud structure solidified before the contents of the pit had even settled and subsided slightly. The vessel was located at the base of pit 1015 at its S most edge sitting in a slightly prepared niche levelling up the floor of the pit. It was orientated with the aperture facing directly into the side of the pit and packed with a collection of figurines and artefacts, some of which had fallen out down the side of the deposit. It was capped by two large sherds, KM1445 and KM1495, which were placed over it in a domed shape. This was surmounted by vessel KM1444 which projected above the surface of the pit and through the floor of the building. It is remarkable that this was never damaged during the construction, occupation and demolition of **B994** indicating its significance and close relationship to the building and its occupants. A thick layer of reddish/brown structural mud debris identical to that of the walls of the building filled the entire floor area of the structure covering the deposits in 1015 without causing any damage. This sort of deposit could only occur in the event of the deliberate and careful dismantling of the building with the wall material being spread over the interior. Gradual erosion or more traumatic collapse would have resulted in very different types of deposits with either wind/water eroded sediments being in evidence or more intact structural material lying on the floor. Neither of these conditions was in evidence.

Description (fig. 42-46)

The bowl is a deep, 20.0cm, asymmetrical vessel with a diameter of 35.0-36.0cm at the rim and 27.0cm at the base. It has a thick, rounded rim which has been damaged in two places, one at a stress fracture which extends down across the flat base. A rectangular aperture at one side is surmounted on the exterior of the vessel by nine protrusions arranged in two rows most of which have been damaged or broken off. Unfortunately, none is intact so it is difficult to know their original form. A broad band of red paint has been applied along the top and bottom of the vessel with various zigzag like patterns descending from top to bottom. About 15-20% of the exterior on one side has been damaged and the decoration destroyed.

The interior of the vessel is more complicated although identifiably representing the interior of a building. Looking down into the vessel with the aperture at the top of the field of vision, there is a small circular, raised projection on the floor with a shallow depression in its centre immediately on the right of the aperture hard up against the wall. Directly above this, over the aperture, are two more projections or tenons which have also been broken. Still on the wall, and at the same level, a single broken tenon is located c15.0cm to the right of the two above the aperture. Centrally positioned on the floor is a large, squared platform with a small depression in the middle. Radiating from, but not touching, the two left corners of the platform are two low sausage shaped ridges which extend to meet the wall of the vessel. The interior wall have been decorated in a more intricate set of patterns of dependent festoons, hatched areas, zigzag like patterns and wavy lines; all as equally incomprehensible as the exterior decoration. The floor and all the features on it have also been painted red as has the area around the aperture.

Two objects within the vessel have been directly associated with it as integral elements of its construction. The first is a ceramic rectangular artefact, KM1532, with a tenon on one of its long sides originally extending slightly beyond the length of the object. This, however, is also broken. The location of this object beside and partially closing the aperture is significant. The second object, a hand sized flat stone, was found lodged at the back of the vessel flat on the floor directly behind the central platform in a position into which it very neatly fitted.

The damage to the various parts of the vessel appears to be quite deliberate and very carefully carried out in order not to destroy it entirely. The wall projections still bear the marks of some type of gouge which was used to remove them possibly also resulting in the damage to the wall of the vessel seen above the aperture. One further extraordinary aspect of this was the very fine layer of a buff/white clay which had been coated over the entire interior of the vessel obscuring all the decoration and concealing the colouring on the floor. This was also applied to the area around the aperture on the exterior of the vessel. Its careful removal during conservation has revealed how this fine wash or slip must have been applied after the initial damage had been done.

Significance of KM1446

Peltenburg very clearly demonstrates the close similarity in detail between the vessel and structures excavated on the site of *Kissonerga* itself. There is no doubt that KM1446 was a model representation of a type construct of a MChal building, perhaps even of one particular structure. The positioning of the model within its pit with the doorway facing S directly into the side of the pit was deliberately done to ensure the model was orientated exactly as its full scale counterparts above ground. The internal arrangements of period 3a and 3b buildings have been discussed above. In two instances, **B855** from period 3b and **B1016** from period 3b, the existence of a specialised floor area in the E quadrant of the building defined by two low mud ridges and focused on a central, low, square hearth exactly replicates that in the model. Two other period 3a buildings, **B1547** and **B1565**, have similar floor arrangements although the posistion of the central hearth is replaced with a pit. The larger period 3b buildings of **B2**, **B4** and **B206** have much grander lime plaster floors with radial floor divisions, which, in the case of **B206**, has developed into a wall. In none of these buildings, however, is the position of the central hearth suitably preserved to indicate its form or construction.

The entrances of most of the period 3 buildings is very poorly preserved with only **B1547** any clear details. It is fortuitous, therefore, that so much information can be gained from the model. All known period 4 entrances from *Kissonerga* and period 3a entrances from *Lemba* open inward to the left with a pivot stone situated on the left upon entering the building. This is exactly the arrangement with the little model. The pivot stone is clearly represented as is a bracket of some sort above the doorway to receive and support the door post. The small model of the door, KM1532, represents a solid door hung on a doorpost which rested upon the pivot and was slotted into the wallhead bracket. Although all the constructional details of the door cannot be represented in such a small model, it is, none the less, interesting to get a glimpse of arrangements which are otherwise unavailable to us.

The function and form of the other wall tenon on the interior wall of the model is unknown but intriguing. It was evidently a significant element in the interior arrangements of MChal buildings for it to have been included within the model although this does not mean that it necessarily served a structural function. The absence of any windows is also a significant aspect of the model. Had these been regular elements in buildings of the period it would be expected that one would have been included in the model. Indeed, the completeness of the decoration on the walls of the model and the way in which the doorway is accommodated leaves no space for any other apertures or features on the walls. This of course accepts that the decoration on the model represents a tradition of similar decoration on the walls of real buildings. Unfortunately, no direct evidence for this exists although fragments of painted wall plaster do occur in a number of buildings, particularly **B206**.

The broken projections above the doorway are the most contentious elements in the building. Peltenburg argues very strongly for a ritual or decorative element of protomes and other such symbols of power, status or affiliation. He also suggests the broken elements of some sort of porch for which we do indeed have convincing evidence with **B2** at *Lemba* and **B834** at *Kissonerga*. He rejects the idea that they may represent the ends of roofing timbers as does Bolger. This is based primarily on the observation that none are portrayed at the rear of the model and that those at the front are arranged in two rows. However, this is not entirely reasonable or convincing. It would be wrong to expect the model to exhibit a faithful rendition of all aspects of a full scale building. The broken projections can as easily be explained from a structural standpoint. Recent experiments in constructing a roof with the rafters running across the building and projecting at the front and back have shown it to be an efficient and straightforward form of construction. In the reconstructions the timbers appear as an irregular row of projections which appear only above the doorway due to the curvature of the building, much as they do on the model. It is also noticeable that two of the projections on the lower row of the model accurately reflect the position of the tenons on the interior above the doorway. Again, experiments with doorpost support brackets do replicate this sort of arrangement giving a double row of projections above the doorway. These experiments and the possibility of a porch construction do suggest that a structural origin for the projections above the model doorway should not be dismissed so easily in favour of more complicated, and more difficult to prove, ideas of ritual protomes.

There are several aspects of the context of the building model which may have a direct relevance to our understanding of certain types of social behaviour associated with buildings. Attention has already been drawn to the orientation of the model in its pit with the doorway placed directly into the pit side. This precise and careful positioning of the model to reflect the position of doorways, floor space and radial floor divisions in buildings above ground is quite noticeable. So too is the very careful positioning of the large flat stone at the back of the model. Peltenburg has rightly stressed the deliberate nature of this addition to the model and suggests its representation of a moveable platform, bench or seat. However, no such evidence has ever been found in excavation. It is perhaps rather more significant that the stone within the model occupies exactly the same position as the model does itself within **B994**. If the stone is deliberate then its position is important then the most important aspect of that position within the building with which the model is most intimately associated is the pit containing the model itself, 1015. Can it be that the stone marks a spot of important ritual significance within the buildings or within period 3 buildings in general? Eight other period 3 buildings at *Kissonerga* have similar internal arrangements to that of the building model with radial floor divisions defining a floor space which has been constructed differently and treated in a manner distinct from other areas within the building. Of these only **B2, B4, B206, B855** and **B1016** may also have square central hearths. In **B206** the area directly to the N of the segmented floor space has been largely destroyed by later pits leaving only the remains of room with a floor of lime plaster which had been painted red. In **B855** and **B1016** the area is preserved but is disappointingly empty. In **B4** the space is occupied by a group of shallow pits and some vessels and artefacts of no apparent importance. **B2,** however, has as one of its main characteristics, a large shallow pit (later cut by Grave 503) cut into the floor at this point which was found to contain two intact pointed RW flasks, KM477.2-3, and a fine stone bowl, KM477.1. It is also of interest that the now famous stone figurine, LL54, was found in this position on the other side of the radial division on the lime plaster floor of **B1** at *Lemba.* The evidence suggesting some sort of ritual point of focus within certain period 3 buildings is still, however, meagre, and its linking with the flat stone in the building model, slender. But, there are significant structural relationships and the fact that three of the most important non-funerary ritual assemblages from the Chalcolithic period are to be found in such a context cannot go unnoticed.

Peltenburg has also drawn to attention the emerging notion that buildings were formally brought to an end during certain periods in Cypriot prehistory and that this end may be accompanied by specific social behaviour. He cites earlier instances of such activity from the late Neolithic site of Ayios Epiktitos *Vrysi* where many artefacts were regularly left on the floors of buildings at the time of their rebuilding or renovation. Such evidence also exists at *Kissonerga.* The building model appears to capture this very complex and little understood aspect of prehistoric society. The deliberate removal of all projections on the model both above the doorway and on the interior as well as the breaking of the tenon post on the door model are seen as attempts at "destroying" or "killing" the important aspects of the building. The defacing of the interior of the model with a white clay and the burial of the entire assemblage within a pit are further evidence of the deliberate concealment of the vessel. These ritual acts carried out in miniature are a microcosm of greater activities performed within the site of *Kissonerga* itself. The evidence for this is now quite convincing and carries important implications for all considerations of prehistoric deposits and our understanding of these sites.

3.5 The Houses of the Erimi Culture.

A review and classification of the various elements and architectural features which combine to make the buildings of *Kissonerga, Lemba* and *Mylouthkia* and an analysis of the materials and techniques used in prehistory to create these structures has allowed the identification of specific architectural forms or building types for the period. The characterisation, above, of certain key elements can be used to define the standard form of building at the time, but, within that form there are clear variants and developments over the thousand year history of the Erimi Culture. These involve changes in size, materials and complexity but in ways which remain true to that original architectural form. It is worth restating those primary characteristics. The standard Chalcolithic house was a circular free-standing building which was constructed in a broad, shallow hollow with walls of mud or mud and stone and a flat earth roof. There were clearly defined and well built doorways and, at the centre of the building, sat a platform hearth with the space around the walls frequently divided by the use of ridges or walls, piers and hollows. Good clay plasters and, later, lime plasters were used for the construction of many of the features inside the building and for surfacing the walls and floors. Timber beams were used for roof supports and, occasionally, as an external element to the mudwall of certain buildings. There is the strong possibility that timber-built structures also existed but these are not common and appear largely to be associated with storage or mortuary areas. Eight clear house types can be identified within this general form. A name has been given to each type in order to avoid too rigid a classification system which does not permit slight variations within each category and to act as an aide to memory. Where possible, site names in which the particular house featured and which is most closely associated with it in the popular imagination has also been used. This avoids type names which highlight certain archaeological or structural elements at the expense of others and which could lead to confusion. Finally, the word "house" is used with some caution. A house is a building or group of buildings in which people perform most of their daily domestic activities and which affords them shelter, a place for storage and some protection. Strictly speaking, many of the Chalcolithic buildings do not satisfy this definition in that they may only be part of a group of buildings which together forms the house or they may, indeed, be a specialised structure to which either the whole community or specific individuals have access. This is particularly true of the later periods. However, words like "building", "structure", or "type" lack impact and soul. They detract from the central domestic role which these buildings served and, in the way of all archaeological terminology, it is inevitable the more familiar term "house" will tagged on to the name in the course of its use and discussion. The word "hall" has also been used in a deliberate attempt to highlight the very special nature of this particular class of building and to stress its particular architectural qualities.

Type	Found'n	Wall	Floor	Hearth	Entrance	Pier	Ridges	Plaster
1	1							
2	1	7	1	3	1,4	1		2,3
3	1	1	2	2,3	1			
4	2	3	2	1,4	2		1	3
5	4	3	3,4	4		1,2	2,3	2
6	1	3	1,4	1,3			2	2
7	3	3	1	3				3
8	1	3,4	1	3	3	3		2,3

Table 5: The eight Chalcolithic building types showing the associated building element types.

Type 1. The Kalavassos Pit House.

Period 2. Kissonerga *Mylouthkia*: **F1**.
Kalavassos *Kokkinoyia*.
Ayious.
Philia Drakos: Late Neolithic levels.

From the growing body of very scrappy evidence there is clearly cause to consider the existence of subterranean dwellings during the inception of the EChal period in Cyprus with earlier indications from the final levels at *Philia*. This now comes from a number of sites across the island suggesting that it is not an isolated phenomenon. In all cases fairly deep pits have been sunk into the earth and at the sites of *Ayious* and *Philia*, subterranean passages are also associated with this phase of activity. The pits at *Kokkinoyia* are generally 2.0-3.5m in diameter, steep-sided and 0.50-1.0m deep with successive earth floors, rubble benches along the edge of the pit and post holes. At *Ayious* and *Mylouthkia* they are larger, 5.0-8.0m, and are associated with many postholes irregularly spaced around the pit. A hearth at *Mylouthkia* and at *Ayious* firepits, paved areas, benches and shallow hollows are further features associated with these pit-dwellings. Bell-shaped pits are another very characteristic feature and now appear at *Maa*, *Kissonerga* period 2 (fig. 12), *Kokkinoyia* and *Ayious*. The most remarkable features of these sites, however, are the underground passage complexes which connect several of the pits but which appear to serve no particular function. There is no evidence from any of these sites of any surface structures or upstanding remains which can be interpreted as dwellings. Todd (1991, 10) suggests that the dwellings were flimsy structures which have been eroded away leaving only the enigmatic subterranean features. Admittedly, the three sites of *Ayious*, *Mylouthkia* and *Maa* have all been heavily eroded and Todd may well be correct, but the evidence from the pits does point to some sort of domestic activity and, in the absence of any more substantial remains, the cautious acceptance of the pit dwelling as a house type in the very early EChal period is not unreasonable.

Type 2. The Mylouthkia Roundhouse.

Period 2/3a. Kissonerga *Mylouthkia*: **B200**.
Illustrations: fig. 8, 10-11.

There is only one example of this type of house from the period 2 site of *Mylouthkia*. The absence of any other such structure from the period may well be a reflection of the denuded nature of most of the known sites of the EChal period. Excavations have also been undertaken at Kalavassos *Ayious*, *Philia* Drakos, *Maa* Palaeokastro, and Kalavassos *Pamboules* and *Kokkinoyia*. Of these, only *Maa* has produced any evidence of surface structures (Thomas 1988) the rest consisting of subterranean pits dwellings and tunnels. The *Mylouthkia* building has survived only by virtue of its semi-subterranean nature being set inside a very large hollow or erosion channel. The preservation of a sealed repertoire of ceramics, tools and other domestic artefacts on the floor of this building has made possible the isolation of a distinct set of cultural pottery and artefact types. So far, it appears to fall within the range of the EChal material culture but the overall proportions of RW painted ware suggest that it most probably belongs to the very end of the EChal period and the possibility that future analysis may even place it into period 3a should not be overlooked.

The building is quite a large structure, 6.20m, and has been constructed in a broad, shallow type 1 hollow (diameter 9.0-12.0m) which is itself founded in a much larger hollow or erosion channel. The walls are unusually and irregularly constructed in a rough rubble core which has been heavily rendered on both inner and outer faces (type 7). There are also stretches where an attempt at inner and outer facing stones has been made and where the rendering is less obvious. Facing S is a type 1 doorway with a stone threshold and to the NW is secondary type 4 entrance which appears to have been punched through the wall after the original entrance had been blocked. The floor is a type 1 earth floor which retains the broadly scooped profile of the foundation cut. A hearth sits at the centre of the building but at the time of writing it has not been completely excavated and details are not available. Projecting from the N part of the interior of the wall is a low type 1 pier. The remains of baked clay fragments containing some organics and reed impressions. These, and the two stretches of ashy charcoal most probably represent the burnt remains of a flat earth roof supported on timber rafters and reeds.

Type 3. The Lemba I Roundhouse.

Period 2. Kissonerga *Mylouthkia*: **B152**.
Maa Palaeokastro: square H/I 35/36.
Period 3a. *Lemba* Lakkous: **B5-6, B8-9, B12, B15-16, B18-19, B20**.
Erimi Pamboules **Huts I-V**.
Kythrea: **Huts IV-V**. (?)
Kalavassos *Pamboules* type I-II.
Period 4. *Kissonerga* Mosphilia: **B1**.
Illustrations: fig. 3, 9, 13, 39.

The very long chronological history of this house type suggests that it may well reflect a standard house form for the entire Chalcolithic period. This does not mean to say that it is the dominant type for any one period, merely that it survived for such a long time that it can probably be regarded as the basic house type. There may indeed be two slightly different types involved although it will be difficult to identify enough differences to make the separation practical in the field. Five of the buildings from this group are characterised by the presence of a ring of postholes around the exterior of the building. These are **B152**, **B18-19**, **B20** and **B1**. The first two of these did not produce convincing evidence of an associated mudwall but they were in areas where erosion was generally very severe and where only remains protected in a hollow survived. The other buildings show all the characteristics of the general Lemba 1 Roundhouse with the addition of the post-ring. The posts are generally not deeply founded, as for **B19**, and tend to be broader than they are deep. However, **B1** produced a range of different post types including small, deeply set posts for narrow timbers. The function of these posts is unknown, but comparison with some of the buildings at *Vrysi* may indicate that they could have been an additional system set up around the building to provide extra support to failing walls. They may, alternatively, have stood as support to the roof. If the latter is the case then an intriguing set of possibilities exist for the interpretation of such a structure, not the least being the prospect of an upper storey.

The standard Lemba 1 Roundhouse was constructed in a fairly well defined hollow which was generally packed with rubble, soil or clay to provide a solid foundation (type 1). The buildings from area 1 at Lemba have floors of a greenish clay which, in section, extends beneath the walls. This produced a good type 2 floor of clay.[1] The foundation of **B1** at *Kissonerga* has similarly been packed with a more rubble-like material of coarse unsorted sediments and rubble. The walls of all of these building are constructed entirely in mudwall from the foundation upwards with no initial stone courses being constructed (type 1) and were set along the edge of the foundation hollow. Some heavy stonework was occasionally pressed into the inner face of the wall at its base to form a very rough sort of skirting. This is most clearly seen in area 1. Artefacts and near complete vessels were also incorporated, broken, within the wall structure. Entrances are generally poorly preserved but are simple type 1 doorways facing S-SE. Low, circular platform hearths of mud, type 3, are located in the centres of the buildings although simple type 2 shallow, lined firepits also occur. The interior floor space can be very "busy" and is frequently subdivided into distinct areas by the use of hollows in the floor, low platforms, low radial ridges of mud, and low mud and stone piers projecting from the wall. Other features like mud basins, grinding installations, pits and socketed stones also take up much of the available floor space.

<u>Type 4-6. The Kissonerga Hall and the Kissonerga and Erimi Roundhouses</u>.

Period 3a. *Kissonerga* Mosphilia: **B1016, B1547, B1565.**
Period 3b. *Kissonerga* Mosphilia**: B2, B4, B206, B855, B1103, B994**.
Lemba Lakkous: **B1, B4, B10, B21**.
Erimi Pamboules: **Huts VI-XIII.**
Kythrea: **Huts I-III**.
Lapithos Alonia ton Plakon west: **Huts 1-4**.
Illustrations: fig. 5, 4-6, 15-25.

The appearance during the MChal period of a distinctively different and spectacular type of architecture warrants recognition by the use of a more formal name. By definition a "hall" is the main room of a great house or the great house itself. In N Europe this has come to be applied mainly to medieval manor houses and stately heaps; however, its origins, even in Europe, are much older and considerably different. The great halls of Iron Age heroic society or the megara halls of early Aegean civilisation indicate how this word has already been applied to very different types of society and periods. By prehistoric standards, the houses of period 3b at *Kissonerga* are quite stately and are

[1]However, see the experimental construction of such a floor in RH3 which suggests it would not survive the construction process.

distinguished by the quality of their construction, the materials used and, the formal delineating of a space or room within the building by radial divisions and a plaster floor. These are the great houses of the Chalcolithic period and, as such, deserve that recognition. This makes no assumption about the type of social organisation which existed at the time nor about the function of the buildings themselves. There are earlier and later versions of the Hall which boast many of its characteristics but which do not warrant the term "hall" due to their smaller size and the quality of their construction. These are the two Roundhouse types.

Type 4: The Kissonerga Roundhouse. There are three of these buildings from the earlier period 3a in the upper terrace excavations at *Kissonerga*. These show an early stage in the development of the building form and reflect more closely their underlying origins within the standard form of Chalcolithic architecture. The buildings are commonly 5.0-8.0m in diameter and are founded in broad, shallow hollows with the walls sitting inside the edge of the hollow (type 2). The walls themselves are constructed with a good stone foundation several courses high of selected limestones forming inner and outer faces with a rubble core and a mud mortar. The upper part of the wall appears to have been built in mudwall and most likely stood a minimum of 1.80-2.0m high. The interior wall finish is a type 3 clay plaster applied directly to the wall. A type 2 entrance in **B1547** faces S but is preserved only on its E jamb with no indication of pivot stone or other doorway arrangements. Two stones set into the floor just in from the doorway have been associated with it as a possible door-locking mechanism. The floors of these buildings are very well made clay surfaces which have been deliberately laid to provide smooth regular surface (type 2). This is most noticeable in **B1547**. The most characteristic features of the building interiors are the two radial mud and stones ridges extending from the walls to the centre of the house where a hearth is situated (type 1). This arrangement is best preserved in **B1016** where a much denuded rectilinear type 4 platform hearth is located. **B1016** is also unique in the presence of a cobbled area within the floor space defined by the radial ridges. A survival of this type of building into the following sub-period, **B855**, boasts a fine clay floor and radial ridge as well as a beautifully constructed rectilinear mud platform hearth which has largely survived later depredations.

Type 5: The Kissonerga Hall. By the following period, 3b, the sizes of the houses at *Kissonerga* had increased greatly with diameters of 9.0-17.0m. For the largest of these, **B206**, a total floor space of 200-225m^2 is estimated. In modern terms this is the equivalent of two large rooms of 10.0x5.0m and four smaller rooms of 5.0x5.0m. giving a house size which compares very favourably with most flats in Edinburgh's New Town, built during a period of great attention to grandeur and scale. The foundations of the period 3b buildings are built with much more attention to detail and structural stability. **B206**, for example, is set into a very broad hollow with a distinct flattened base along the edge upon which the wall has been built. With **B855** even greater care has been taken with the construction of a stone platform (type 4) along the W of the building to provide a firmer foundation for the wall. The walls are constructed in much the same manner as those of the earlier period 3a but generally on a larger scale with better constructed stone footings. By far the most characteristic feature of these buildings is the use of lime plaster for the floors and walls. It is quite clear from **B206** that the interior walls of some of the buildings were finished in a thick mud render which was plastered over with a layer of fine lime plaster and, occasionally, painted red or pink and white (type 2). At the centre of each building sat a hearth which is thought to have been of the rectilinear platform variety but as none survives this assertion can only be made with some caution and with reference to the preceding period as well as the building model KM1446. Floors were frequently finished in a thin lime plaster which was applied directly on to the earth surface particularly in the N half of the buildings (type 3). This is seen in both **B2** and **B206** where the floor may also have been painted red. Each building, however, is characterised by a massive lime plaster floor (type 4) situated in the SE quadrant of the building and bounded by two radial floor divisions which spring from the wall and terminate at the hearth. In **B206** one of these divisions survives to indicate that it stood as wall and not just a low ridge, clearly indicating a distinct segregation of this area of the building from the rest. Only the foundations survive in the other buildings making a characterisation of their form difficult. No entrances are preserved from these buildings apart from the E door jamb of **B4** suggesting a type 2 doorway facing SE. No evidence survives to indicate the type of roofing although, by comparison with evidence from other building types, it is most likely to be the flat earth roof. However, no postholes nor any possible post platforms were uncovered inside these buildings creating daunting problems about the reconstruction of a roof arrangement. The only possible postholes associated with the interior of buildings during this period are the massively constructed 1021 and 1059 which are within the limits of **B206**. These are on the scale which would be necessary to support the size and weight of roof which must have covered the building but, unfortunately, no clear stratigraphic links survive and it is a matter of speculation that they are indeed contemporary.

Type 6: <u>The Erimi Roundhouse</u>. One final building of this type belongs to the very end of the period 3b occupation at *Kissonerga* and to the later levels at *Erimi* and may reflect changes which were engulfing society at that time. **B994** retains some of the characteristics of the Hall, the wall construction, the foundation hollow and a rudimentary radial division but is considerably smaller in size and lacks the formal plaster floor which so distinguish the type 4 buildings. Its association with the remarkable deposition of the hoard within pit 1015 also sets this building aside and may indicate that it was of a specialist nature as well as being late in the sequence. **B4**, **B10** and **B21** all from *Lemba* may also fall into this category of building type. Their remains are badly preserved making an assessment of their characteristics difficult but it is interesting that they appear to follow the same sort of pattern as **B994**. One of the buildings, **B4**, is also unusual in having a large part of its interior covered by a type 4 plaster floor. It may well be that a late period 3b architectural type exists containing elements of the much grander Halls of *Kissonerga* and which should be given a separate classification. This is type 4, the Erimi Roundhouse. It is characterised by mudwall construction on stone foundations set in a well defined shallow hollow, earth floors, rudimentary radial floor division and, some use of lime plaster. The 11 clear examples of this type of house from *Erimi* and the 3 from *Kythrea* indicate that a much more cluttered arrangement exists for the interior of these buildings with stone platforms, low stone and mud ridges defining areas against the walls, basins and, work areas also characterise these houses.

Four other possible examples of this house type also come from *Lapithos* although the very badly preserved nature of these structures adds little to our understanding of them.

<u>Type 7: The Kissonerga Square House</u>.

Period 3a. *Kissonerga* Mosphilia: **B1161, B1295**.
Period 3b *Kissonerga* Mosphilia: **B1000**.
Illustrations: fig. 6, 26-8.

The three surviving examples of this type of house present some consistent differences from all other house types on the site. They are all characterised by three straight walls with rounded corners much like the earlier houses of the Sotira Culture, and by a fourth wall which is either markedly bowed or angled on plan effectively creating two shorter stretches of wall. They are all set into fairly deep straight-sided foundation hollows cut into the hillslope along the N of the building site where the wall foundation is balanced partly on the side of the hollow and partly over the edge of the hollow supported by a base of mud and pebbles (type 3). The walls have well-built stone foundations of limestone and sandstone set in mud with inner and outer facing stones and a mud and rubble core. It is assumed, by comparison to other structures from the period, that the upper part of the wall is built in mudwall although none survives. The floors of the buildings are a well laid clay which is carried up the walls as a clay plaster. In **B1295** crushed limestone or a very poor lime plaster has been used for both the floor and the wall plaster. The interior corners have been built out with the plastering to give a more rounded appearance to the wall. A possible type 2 entrance may exist in the S corner of **B1161** where it has been blocked up to be replaced by a type 4 entrance to the E facing on to the cobbled area. No other entrances survive but a possible threshold stone along the S wall of **B1000** may indicate its position in that building. A low, circular type 3 mud platform hearth occurs in the middle of **B1295** and in **B1161** a secondary type 5 tanour-like oven has been inserted.

<u>Type 8: The Lemba II Roundhouse</u>.

Period 4. *Lemba* Lakkous: **B2-3, B7, B11, B17**.
Kissonerga Mosphilia: **B3, B86, B96, B98, B204, B376, B736, B834, B866, B1044, B1046, B1052, B1165**.
Ambelikou Ayios Georgios.

Illustrations: fig. 4, 7, 30-41.

This type of house is the most commonly recognised form of the Chalcolithic roundhouse from the later levels at both *Kissonerga* and *Lemba*. This period has not been recorded from other sites where architecture has been found and, for the time being, this building type is unique to the SW of Cyprus. It bears many elements which can be recognised from earlier buildings, particularly the Erimi Roundhouse type, but it also has arrangements and a form of construction which appears to have emerged only during this period. The buildings are generally of medium size, c6.0m diameter, although larger ones of 8.0-9.0m diameter also exist. The foundation of the building is frequently very deeply cut and exhibits a very pronounced dished shape in profile (type 1). The building is set inside this hollow. There is a very distinctive type of wall construction in stonewall in which small stones are set coursed in mud with very little distinction between the facing stones and the rubble core (type 4). A good proportion of the wall consists of the thickly laid mud mortar and the walls are generally finished in a fine clay plaster (type 3). This is frequently brought down to the floor where it is built out slightly to form a smooth, continuous curve with the dished floor and may be stabilised along the base with sherds or pebbles pressed into the clay to form a skirting, **B1046**. Where this sort of plastering has not been used, larger well laid and fitted stones may be set along the foundation of the wall to form a much more durable skirting along the interior wall base, **B86**. Floors, where they can be detected, are of plain earth with no deliberately laid clay or plaster and are formed purely by compaction through use (type 1). In parts of the building where there is not a great deal of traffic, as along the walls or amongst storage vessels, the floor can be very poorly developed and difficult to locate. Entrances face in almost any direction and form another diagnostic aspect of the building (type 3). The door jambs are carefully constructed in stone and mud without the use of larger stone blocks and can be expanded to a width slightly larger than the thickness of the wall for extra stability and strength. The threshold was formed as a continuous surface between the exterior surface and the floor of the building but could also be furnished with a stone or cobble base. Inside the building, immediately to the left upon entering, was a pivot stone set into the floor and, directly in front, was a quern stone set upright into the floor between the door and the hearth. At the centre of the building sat a low mud and stone built circular platform hearth (type 3) which formed the focus of the house. The hearth in **B3** was finished in a very coarse and poorly applied lime plaster which indicates that the technology had not entirely disappeared by this period.

These are the most characteristic features of this type of building but it should be noted that many other aspects are also significant. There are no ridges, benches, piers, or platforms although stone settings generally associated with storage vessels are very common and, indeed, can occupy much of the internal floor space of the building. There also appears to be a much greater emphasis on special function buildings during this period and the grouping of structures around an open space onto which they all have access. The *Lemba* building group is a good example of this although other such groupings can also be suggested for *Kissonerga*, for example: **B86**, **B204** and **B376**; or **B834** and **B1052**: or **B1/B98, B1044** and **B1046**. It is also at this period that possible porches at the entrances to some of the larger buildings appears for the first time, **B2** and **B834**.

3.6 Summary.

From the foregoing discussion it is apparent that the various elements of Chalcolithic buildings; the walls, floors, entrances and fixtures do fall into regular categories or types. These have been described and an indication of their chronological spread as well as their appearance on various sites has been indicated. Each element has also been manufactured in a certain way and with certain materials which have all been identified and described. Observed patterns of change in the use of materials and in methods of manufacture have also been traced and these are linked to groups of other elements which are specific to certain building groups and periods. The changing types of walls with increasingly competent stonework and mud technology, or the change from mud to lime plasters being demonstrated are two instances of this sort of development. Changes in the size of buildings, the orientation of doorways or in hearth types are also considered. The importance of the building model KM1446 has been discussed and the unique information which it can provide has also been indicated. Finally, various well-preserved buildings have been examined and an assessment of their materials and deposits made based on information assembled from a study of mud behaviour (chapter 2) and site formation processes (appendix 2). Clearly, this amount of information can be used to identify formal building types and from that, to chart the change and development in Chalcolithic architecture over the millennia. This will be carried out in the final discussion in chapter 5.

The classification of building elements, which has been described, will also be a useful tool in its own right under fieldwork conditions where archaeological remains are frequently badly preserved or in a state which is not complete enough to establish its place within the larger scheme proposed for Chalcolithic buildings and features. It is hoped that the present work will have gone some way towards facilitating this process.

Chapter 4: The Lemba Experimental Village.

I hear and I forget.
I see and I remember.
I do and I understand.
Proverb.

4.1 Genesis of the Village.

The reasons for the establishment of a centre for experimental archaeology have been explained earlier in chapter 1.3. For the current project this involved establishing ways of trying to understand the types of structures which existed on prehistoric sites, what materials were used, and what impact these structures would have on the formation of an archaeological site. Other experiments were always envisaged as an important part of the experimental village although the visual impact of the building experiments was always acknowledged as an important aspect of the site. To date, several other experiments have been carried out into food processing and cooking **(E21)**,[1] ceramic manufacture **(E25)**,[2] saunas **(E22)**,[3] and artefact burning and burial.[4] It is hoped that many more will emerge from the long term development of the LAP and will enhance the value of the LEV. However, for the present, only those aspects of experimental work which relate directly to buildings and site formation will be considered.

Aims.

The experiments with the different materials of mud, clay, stone and lime plaster were carried out in order to understand the prehistoric methods which may have been used to create them and to begin building up a reference collection of materials samples and experimental features which can be used in the identification of prehistoric remains. This is obviously a long term project and will not be completed for many years to come. The reconstructions of the houses were carried out for three main reasons: 1) To test ideas about the practicality of certain building types. 2) To observe the archaeological behaviour of specific building elements, for example, postholes, wall bases, floors hearths etc. and 3) To observe the formation of an archaeological site and through its excavation, to record and categorise types or groups of archaeological deposits. Again, this is a very long term project and only some initial results can be included at the present. Three building types have been investigated by reconstruction and are represented by **RH1** (type 5), **RH2** (type 8) and **RH3-5** (type 3). These types are explained in chapter 5. The second aim of reconstruction has initially tackled five

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[1]This project was carried out by Prof.E.Peltenburg using preheated stones set into a fire pit. The food was edible but the development of further culinary skills using this method would be recommended.

[2]A series of experimental firings of clay plaques was carried out by Ms.J.Sheilds in order to determine possible prehistoric kiln types and clay sources.

[3]The sauna was carried out by Prof.E.Peltenburg in order to demonstrate one possible use for the many stone-filled fire pits which are to be found on Chalcolithic sites.

[4]This was carried out as part of her PhD research by Ms.C.McCartney.

aspects of archaeological features: wall construction, floors, roofing, post supports and plasters. The observations presented on the archaeological history of these features on the site form the preliminary conclusions which can be derived from this part of the project. Five small excavations were also carried out and, together with the work done at *Souskiou* (appendix 2), will constitute the first contributions to considerations of site formation processes and their relation to archaeological deposits. This is the program which will begin to fulfil the third aim of reconstruction.

Location of Experiments.

An important initial consideration of the project was the siting of the experiments. Survey work in the first year of the LAP excavations at *Lemba* indicated that the archaeological site extends from the main Paphos to Kissonerga road westwards to the terraces below Area I (*LAP 1*). Obviously, any construction or work in the area would be within the confines of the site and may even cover important archaeological remains. The terrace to the N of the site was considered as a suitable location as very little had turned up there during survey, but all permits restricted any work to the fields in which the site was known to lie, effectively ruling out this possibility. The excavation of the site of *Lemba* revealed deposits which were fairly close to the present surface and which had been badly damaged by agricultural activity. In only one area was this not observed. The strip of land between the main excavated site of Area II and the kafkalla terrace to the N was more deeply buried and protected by a thickness of eroded and plough disturbed soil which was at least 0.50m deep. The site itself was also seen to more heavily eroded in this area. Consequently, it was decided that the experimental work was to be established within the fenced area of the excavations but to the NE where deposits were known to be better protected (fig. 62). This created the situation of juxtaposing the excavated remains against the experimental reconstructions; a relationship which was latter to be exploited for site presentation purposes.[5]

Materials and Tools.

The materials for the experimental work and for the reconstructions were all derived locally. The only exception to this was the roofing timbers which could not be acquired by scavenging or from local timber stands; as this would have ensured considerable local objection. All timber was consequently bought from the Cyprus Forestry Commission which prided itself on being able to supply timbers larger and straighter than requested. The myrtle branches used in **RH1** were obtained in a slightly more clandestine manner which provided a much needed pruning service along the backroads behind *Lemba*. All other material was obtained free and with very little trouble from within half a mile radius of the site. Soil was dug from the field itself and from the spoil heaps of the earlier excavations

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[5]The question of site presentation will not be considered in the current work although it is an important part of the entire LEV project and does have implications for the development of the experimental work. These will be mentioned where appropriate.

for the construction of the walls. For the roofs the white clay rich soil was available in quantity in the underlying havara subsoil and for the render, from the reddish brown soils overlying the kafkalla terrace to the N. The kafkalla ridge itself provided the source of the material for the manufacture of the lime plasters. Stands of bamboo can still be seen in places along the two streams which have created the narrow canyons to the N and S of the site. These were freely growing producing good upright canes which were ideal for roofing material. Their use by the project was sanctioned by the *mukhtar* of the village, Mr I Clientes. Straw which was also used in both the mixing of the mud and in the roofing was obtained from the fields around the site with the approval of the farmer, Mr Seraphim, and his family. An alternative material to this was seaweed which could be picked up freely along most of the adjacent coastline where it lay unused and where it restricted the enjoyment of the beaches by the tourists. Stones also were available in plenty from the surrounding fields and from old excavation dumps. These included unstratified querns, rubberstones, socketed stones and pivot stones which were used in the reconstructions. Water was available in bulk through the irrigation system established by the Paphos Irrigation Project.

There has been some debate in connection with reconstruction concerning the methods employed and the types of tools used. Experiments have been carried out specifically to understand this aspect of primitive technology and to demonstrate the effectiveness, labour input or outcome of the use of a particular tool type. The present set of experiments were not concerned with tool type or use but rather with the buildings themselves, the materials used and the formation of archaeological sites. Excellent work has already been carried out in this respect; for example, the use of ground stone tools in wood cutting and wood working (Carneiro 1979). The results of these experiments are accepted and it was not felt necessary to undertake the complete construction of a building from the procurement of materials to final construction using only the tools which would have been available in prehistory. The need to buy in timbers from the Cyprus Forestry Commission meant that there was no control over the way in which the timbers were cut or in the quality of the timber.[6] Ironically, the timber which was used in the reconstructions may be of a much higher quality than would have been the case three-four thousand years ago. We had access to more timbers which are straighter and longer than the types of trees which now grow in the Ktima Lowlands. This would have had a significant impact on the construction of the larger houses like **RH1**. Modern tools were also permitted during the reconstructions. Picks and shovels were used for digging the soil and a coarse mesh sieve for sorting it was also used from time to time. Materials were transported in modern buckets or wheel barrows and water was brought to site in large containers and stored in several oil drums. Initially, this was tolerated and it was accepted that an understanding of time and effort involved in this stage of the construction process could never realised. However, it soon became apparent that this policy was being applied at all levels of the experimental process by one of the builders who, of necessity, was working unsupervised, and that much of the building work for **RH1** was also carried out using modern tools.

[6]The supply of timber was administered through the Cyprus Department of Antiquities as part of a grant awarded to the project. There was no direct liaison between the project and the Forestry Commission which could have been more productive in procuring more suitable timbers.

Although this did go beyond the aims and limitations of the original project it was not thought to be entirely detrimental. However, in order to test the proposition that it did affect the outcome of the experiments all future work was carried out with as little use of modern equipment as possible during the construction process. It was surprising to discover how effective such an approach could be and how little modern tools were missed. For example, rather than using plumb bobs and spirit levels, walls were kept in the vertical by eye as was the level of each course where the horizon over the sea proved to be an effective guide. Stones were efficiently dressed in **RH2** using hammerstones rather than a modern metal hammer and wall surfaces and renders were smoothed using hand-held rubbing stones.[7] The final result of these and other practices was quite satisfactory and their use was adopted as policy for further experimental work on the site. **RH1**, however, continued to be maintained and improved using modern tools and eventually even modern materials. It had very quickly become apparent that this building was regarded by various members of the LAP and the public as the major showpiece of the LEV. Its experimental value in the process had become diminished and the tacit decision was taken that this building should be kept in order purely for presentation purposes. It can now no longer be fully considered part of the experimental process.

4.2 The Experiments.

In connection with the study of prehistoric buildings five types of experiment were carried out at the LEV. Most of these were part of the five reconstructions which are described below, but it is worth collecting the related experiments together to form a more comprehensive discussion and to observe how such work can develop as the research progresses. The five types of experiment were concerned with: 1) the construction of earth walls, 2) stoneworking, 3) roofing, 4) earth floors, and 5) plaster making. The majority of the experiments are incorporated within the five reconstructions and will be described under those categories. However, a group of experiments was carried out as a prelude to the reconstructions and, as such, stand separately. These include the initial work with earth and mud walling and the various attempts at the manufacture of lime plaster.

Mud and Earth Wall.

Five separate experiments were carried out in order to understand the different methods used in the construction of earth and mud walls and to test the suitability of the local soils for the purpose. The decision to construct in mudwall was based on the available archaeological evidence which has been described earlier. The first experiment was carried out on top of the stone plinth for **RH1** but was subsequently demolished in order to construct the wall using a more successful formula. The other four experiments were located to the S of the four major roundhouses. Work with mud brick and pisé was

[7]These stone tools were genuine Chalcolithic hammers, rubbers, pounders and anvils which can be collected freely from the ploughsoil in fields around the site.

also initiated as a test to observe the behaviour of these methods with respect to local soils and conditions and as a demonstration of the archaeological evidence which would be expected had they been used in prehistory.

Mudwall (fig. 66, 84-5, 106-7, 114-5).

The initial attempts at construction in mudwall were carried out in two experiments both of which provided valuable information about the technique as well as familiarising the team members with working in mud. Soil quarried from the surrounding site but more specifically from the excavation spoil heaps was used throughout the experiments and reconstructions which has been described earlier. The soil was initially very roughly sorted by hand in order to remove all the larger stones, sherds and pebbles (approx. > 20mm) which could interfere with the use of the material and could be a potential source of injury to anyone mixing the mud barefoot. When it was established that this was indeed a successful method for the removal of sharper larger elements it was decided that, in the interests of speed and for the greater convenience of the builders, that the soil could be passed through a 1mm mesh sieve. This was used only to isolate the larger elements and it was the normal practice to reintroduce all pebbles <20mm to the material. The soil used for mixing the mud, therefore, included all the gravels and most of the smaller pebbles with only the larger stones, cobbles and sharper elements being excluded. It was discovered, however, that during construction it was necessary to pack these large stones into the top of the wall in order to key in further layers of mud. This effectively meant that all the material quarried was eventually used in the wall building apart from a class of stones which were characteristically c5cm in length and angular with sharp edges. All of these appeared to have been either heat cracked or broken and chipped in some manner.

The inclusion of organic material has always been a significant element noted in the analysis of prehistoric muds and in more modern mud brick and mud mortar. Reasons for this inclusion have been discussed above and include; the releasing of bonding agents into the mud, the absorption of moisture during the drying and setting of the mud and, the creation of a structure or framework to consolidate the mud while it sets. Stalks of grasses, most commonly, straw appear to be the favoured material both recently and in prehistory although seaweed has also been noted. The threshing of grain in Cyprus is traditionally carried out on a special threshing floor usually in an open area on the periphery of the village. This was accomplished by dragging a wooden sledge set with flints across the harvested plants and then tossing the crushed material into the air to separate the chaff from the grain. Modern practice is to use not a donkey and sledge but a threshing machine of a type which was once common over most of this country as well. The result in both cases is the creation of heaps of fine chaff straw of 10-20mm length which had very little value and was usually left to disperse in the wind. The longer straws of >100mm length were more useful and were generally kept to be used by the farmer or sold on for other purposes. Our experiments initially used only the shorter, more available, chaff which proved to be inadequate in that it did not provide two of the basic criteria for the inclusion of organic material. It did not establish an adequate framework and its absorption capabilities were limited. Accordingly, longer straw was used where possible but the timing of much of the construction and experimental work meant that harvesting had already taken place and very little of this straw was available. An alternative was sought by investigating other materials used in traditional buildings and in prehistory. Seaweed was commonly used as an element in roofing even in villages removed at some distance from the sea. Its presence in ancient mud bricks from *Maa* also argued for its antiquity and acceptability as a building material. The seaweed consisted of thin strips of brown leaf which were usually no more than 5-6cms long and 1cm wide. They are considerably less robust than straw but did serve to hold the mud together and provide a suitable framework around which to set. It is unlikely that such a thin plant fabric could have helped much with the absorption and retention of moisture during the drying of the mud, although its decay could still add the appropriate binding agents into the mud matrix. A further source of organic material included in the soil for the mud base came from the many rootlets and small plants growing on the surface of the spoil heaps and incorporated deliberately during the quarrying of the soil. This material was variable and never comprised a substantial proportion of the total bulk.

Water, of course, is the key element in the making of mud. The behaviour of the clays when water is introduced have been described above were it is obvious that relative proportions are quite crucial in determining the strength and plasticity of the mud. With the type of construction being employed it was essential that the mud should be in a fairly stiff and cohesive state when applied on the wall. It was also obvious that the lower the moisture content the less would be the shrinking of the clays during drying resulting in far fewer cracks and a much more stable wall structure. This was at odds with the amounts needed to ensure a thorough and easy mixing process in which a fairly fluid and workable material was needed. By preparing the mud mixture at least 24 hours in advance this difficulty was avoided and the mud benefited by a more thorough penetration of the moisture into the entire mixture. Mud that was used immediately upon mixing tended to exhibit pockets of dry material which could not be eradicated no matter how complete or thorough the mixing process. The delay in the use of the mud, especially if longer than 24 hours, may even have allowed the process of decay to begin and the subsequent release of minerals to take place.

E2. The first attempt at construction in mudwall was assembled on top of the plinth for **RH1**. This was designed to test the methods used and also the strength of the material. A short stretch of mudwall 2.0m long and 0.45m high was, accordingly, constructed to the W of the future doorway of the reconstruction. It was constructed in 4 layers heaped one on top of the other in a slight ridge which was deeply scored by a shovel in order to key in further layers. No pebbles larger than 2.0cms were included and only the short straw chaff was used. An elaborate system of weights simulating the pressure of a roof was also constructed on top of the fourth layer. It consisted of three beams radiating from the centre of the building resting on the stretch of wall at one end and supported in the centre on a post. Stones giving a total weight of c400lbs were added onto the top of this and covered with a plastic sheet to afford the sort of protection a completed roof would have provided. This experiment was carried out during December 1987- January 1988 during a period of wet and windy weather. Within a few days of construction major cracks 3.0mm wide appeared on the wall head and the SW corner had collapsed. Eventually three serious vertical cracks 2.0cm wide developed extending almost across the wall and splitting it from top to bottom into three distinct segments. It had become structurally unsound and was subsequently demolished. The development of these cracks if replicated for the entire wall height would pose a serious threat to the construction of an entire building in such a fashion. This experimental wall, therefore, highlighted some defects in our proposed method of construction which needed to be reviewed and altered. It also successfully demonstrated the longer term strength of the material and the ability of the wall edges to withstand considerable storm action.

The failure of the first experiment came about through several deficiencies in the mixing and laying of the mud courses. It was decided that greater strength could be achieved by using longer or larger pieces of organic material which would provide a better framework and may even deflect or reduce the effects of the development of cracks. Stones were also incorporated in each layer for this same purpose. Far more important, however, was the question of moisture content and drying. It had become evident that the mud was being laid in too moist a state resulting in slumping and immediate fissuring. The failure to allow the previous course to dry before the application of successive courses ensured that once a crack opened it was transmitted to all layers in the wall forming fissures for the entire height and width of the structure. It was essential that all cracks had stabilised before a new layer was added or this problem would be unavoidable and, ultimately, destructive. Each layer had to be dry before a new one was added.

E4. A second stretch of experimental mudwall was erected to the S of the main area of the reconstructions c4.0m SE of **RH2**. This wall was built in tandem with the actual construction of **RH1** and was designed to investigate the erosion of an exposed mudwall which had been built in the same fashion as that of the building. The deficiencies in the earlier attempt were rectified by adding greater amounts of straw or seaweed, laying lower courses and allowing each one to dry before further courses were added, and by including larger stones at intervals within the mud layer. The wall was built on an arc 3.05m long, 0.70m wide and stood 1.05m high. This was built on a stone plinth of large undressed blocks of sandstone and calcarenite set as inner and outer facing stones with a mud and rubble core. A mud mortar, mixed in much the same way as the basic mud superstructure but without the addition of organics, was used to secure and bed the stones. The plinth stands 0.40m high and comprises 132 stones ranging from small fist-sized chunks to large blocks c0.50m across as well as 42 litres of soil. The mud superstructure was laid in 7 courses each c0.10m high. The soil for each course was roughly sorted in the manner described for **E2** and mixed with seaweed and enough water to give it the consistency and appearance of a large fresh cow pat. This was allowed to mature overnight during which time it became slightly drier and stiffer but still plastic enough to manipulate with a shovel or by hand. This was laid in courses into which larger, fist-sized stones were added to reduce cracking and to key in subsequent layers. The total volume of soil in the mudwall part of the wall was c1500 litres and of stone c170 litres (4 wheel barrow loads). Roughly 190 litres of water and the same of seaweed

(7 large sacks) were also included in the estimates. At the time of construction, therefore, soil comprised 72% of the total bulk of the wall, stone 8%, organics 10% and water 10% although this latter will now vary according to weather conditions. The top and sides of the wall were roughly smoothed but not rendered. The mud for the wall was mixed slightly to the E of the structure in an area now occupied by **RH5**. It was constructed in autumn 1988 and took c4.5 man-days of work time.

Within a few months of its construction the wall was quite badly damaged in the winter rains but was repaired and has not been altered in the 7 years since then. After its initial damage the condition of the wall stabilised over the following summer creating a very solid and strong structure which became resistant to all but the more persistent and gradual erosional processes. The drying of the clays in the mud caused cracking within each of the layers to develop during the construction of the wall. Each vertical crack was characteristically 0.5-1.0cm wide and spaced roughly every 10.0-30.0cm along the mud layer. A continuous horizontal crack was evident between each of the layers. The open part of each crack penetrated the wall by only 1.5cm max. although hairline cracking could be observed to penetrate by up to 20.0cm. At no point was any block of mudwall seen to become detached from the rest of the wall despite giving the appearance of a wall built in large, irregular mud blocks or bricks.

It very quickly adopted the more rounded appearance of an exposed mud wall with no sharp corners or angles. The upper surface has lost about 1.0cm of height in the interim although this is greater towards the edges where the larger gravels and smaller stone chips are more clearly evident. On all sides a thin layer of finer clays has formed and is continuously renewed as more material is eroded off the wall. The W facing side, which is exposed to the prevailing storms, has developed deep fissures some several centimetres broad and penetrating the wall head by 1.0-2.0cm. They have not yet developed to the base of the wall and are thought to follow the weaknesses provided by the cracks formed during the initial drying. A distinct talus or apron of eroded material was see to form along the base of the wall burying the lower courses of the stone plinth and creating a more gradual slope between the wall and the ground surface. This was very quickly colonised by various plants which helped to consolidate the deposits and trap further material being eroded from the wall or being blown from other parts of the site.

In September 1994 the N end of the wall was sectioned down to the original ground surface and record taken of the internal wall structure and of the accumulated deposits. There was a build up of 12.0cm of compact eroded silts and clays around the base of the wall which tailed away to 1.0cm at a distance of c30.0cm from the wall. There is some evidence of sorting of these elements with the finer clays being carried further away from the wall forming a rough gradient of laminated silts. Internally, very little could be seen of the layered build up expected from this type of construction. It was only apparent in the lower courses where the intersection between the layers was evident as less compact, sorted lenses of silts and gravels. Vertical cracks also defined this type of structure as well as the illuvial deposition of fine clays along the cracks. Seaweed, included in the mud mix, was quite apparent at these intersections where its structure survived intact although, throughout the rest of the mudwall it had decayed beyond recognition and gave a very poor representation of its original volume. Laminated layers of fine silts and clays had formed and dried on all wall faces and on the top but were thickest on the W facing side.

Mud brick (fig. 66).

E18. A short stretch of wall built in mud brick was constructed in March 1991 a few metres to the N of the previous mudwall experiments. The intention of building this small structure was to test the suitability of the local soils for this type of wall and to investigate the type of archaeological remains which would result from its collapse or erosion. It was hoped that this could act as a piece of comparative archaeology to compare with other forms of mud construction using the same materials and as a demonstration of its absence on Chalcolithic sites.

The stone foundation was built in much same way as described for the mudwall experiment with inner and outer facing stones, a rubble core and a mud mortar. It was 1.0m long, 0.50m wide and 0.15m high. The bricks were made from soil collected from the spoil heap to the S of the site which was mixed in a ratio of soil:straw:water of 5:1:1. This was not allowed to mature but was made directly into bricks and shaped roughly by hand with measurements of 18.0-20.0 x 10.0-12.0 x 5.0-6.0cm giving oblong, rounded bricks. Sixty bricks were made and were dried in the sun over 2 days before being laid on the stone foundation to form a wall 0.50-0.70m high. A mud mortar made from the same materials as the bricks was used to set them. This wall was allowed to stand without the protection of any render or plaster.

A year later the bricks were still very distinct although the outer ones had adopted a more rounded appearance and some of their surface had been removed exposing the coarser gravels and straw. The mortar had begun to erode out from between the bricks to a depth of c1.0-2.0cm which loosened those bricks near the corners causing them to dislodge and fall from the wall. A small talus or apron was seen to build up around the base of the wall which formed an ideal soil for colonisation by various plants.

Pisé (fig. 66-71).

E17, E20. Two experiments in pisé construction were attempted to the S and W of the mudwall experiment and several metres S of **RH2**. The first of these, **E17**, was built on a stone foundation while the second, **E20**, was constructed directly onto the ground surface. The principle aims of these experiments were: to demonstrate the technique using materials and tools which would have been available in prehistory, to examine the type of wall and deposits which would emerge from such construction practices and, to highlight characteristic differences which exist between pisé and mudwall. These experiments were carried out in March 1991.

The first attempt at pisé construction was set upon a short stretch of stone foundation which was built two courses high 1.0m long, 0.45m wide and 0.17m high. The stones were undressed sandstone and calcarenite blocks set in a mud mortar with inner and outer faces and a rubble core in much the same fashion as excavated wall foundations. With this type of stone construction it is virtually impossible to obtain a completely flat and regular surface or face which is acceptable when dealing with mud. The soil was quarried from mixing holes used in the previous season for the construction of **RH3** where some of the mud mixture still survived. Its time spent maturing for five months had improved the quality of the soil and the recent end of the winter rainy season had ensured that it was still fairly moist but not damp. When compressed in the hand the soil retained its shape and cohesion without the appearance of any moisture on the surface. All the organics had rotted away leaving a soil of coarse sands, silts and clays with very few small pebbles. Initially, the pisé wall was constructed without the use of any shuttering by pounding layers of soil directly on top of the stone foundation using a flat stone for the purpose. No water was used. It very quickly became apparent that it was virtually impossible to create a wall with vertical sides as the continuous pounding ensured that the edges were in a constant state of collapse. Only a tapered or mounded type of formation could be achieved which could never reach any great height. Clearly some sort of shuttering had to be employed.

A second attempt using shuttering on top of the stone foundation was carried out after the first efforts were demolished. It was essential that the shuttering should be strong enough to withstand the pressure of compression without distorting or breaking. Rush matting or wicker panels were considered but were quickly abandoned after a few simple trials as to their suitability. Both could have acted as exterior frames for an earth filled wall core but, were not sufficiently strong for pisé construction. Wooden planks provided the answer. Under traditional construction methods these are held together using tie logs and ropes which extend through the wall. This is an elaborate and quite developed technique which was thought to be inappropriate in Chalcolithic Cyprus. Accordingly, wooden posts set along the edge of the wall were established in order to hold the shuttering in position. For the lower courses this would have been adequate but it is thought that some sort of through ties would have been necessary higher up the wall. Ropes held the posts firm at the top and prevented them form splaying outwards. The soil was quarried from the same mixing hole and rammed into position between the wooden shutters using a wooden pole. The deficiencies of a stone foundation of undressed masonry very quickly became apparent as it was impossible to get a flat face along the edge of the shuttering which allowed soil to escape downwards through the gaps and formed a very serious point of weakness in the wall. When the shuttering was removed in order to raise it and construct the next course much of the face of the lower course disintegrated and collapsed. The addition of a second course caused further cracking due to lack of support along the wall faces which led to major collapse of most of the experiment. It was accordingly abandoned. A section was cut across the N end of the wall which showed that the soil was very poorly compacted and was not, structurally, very sound. The main cause of failure of this section of wall was the inadequate foundation provided by the stone plinth. It was obvious that this could only be achieved by using dressed, well coursed masonry for which there is no evidence in prehistory.

A third section of pisé walling was constructed to the W of the earlier attempts. The wall was 1.0m long and 0.50m wide. No stone foundation was used in this case although the set up for the shuttering was much the same. Six posts were used to hold the shuttering in place on the ground and ropes were tied around the upper parts of the posts to hold them firm. Soil was quarried from the same source and was laid in shallow layers of c5.0cm to allow for greater compaction to take place. It was pounded in position with a wooden pole and each layer was finished off with a flat stone. Each layer was allowed to become completely dry before the next was added in order to provided a firmer foundation for subsequent layers. Even with this level of support the shuttering did begin to spread at the base and one of the planks began to show signs of splitting. As the shuttering was removed and raised for the next layer it was evident that the wall was very compact and sound although some cracking could be seen. There was also a problem with gaps at the corners due to warping and pressure which was rectified by plugging with any available material. During the construction of the upper courses some of the lower courses began to collapse along the edges and had to be supported with a low earth bank. This was not thought to be a serious problem as it did not affect the structure for any depth. Similarly, the corners, although damaged, could be rectified as the construction progressed. It is apparent, though that this type of construction would leave very distinct archaeological remains in the form of postholes both inside and outside any building.

A year after the two sections of wall had been built an inspection was carried out which anticipated their complete destruction in the winter rains. Surprisingly, both had withstood the wet season extremely well. The heavy winter rains had not removed the soil as expected but had rather consolidated it in position before it was baked in the dry summer sun. There was almost no evidence of erosion to the extent that **E20** still had sharp edges and sides with the various layers still clearly visible. **E17** on the stone plinth had collapsed during construction and was hence more poorly preserved but still, stronger and more solid than when initially constructed. It is evident, then, that such walls do need a period of weathering and consolidation before their full strength can be achieved.

In September 1994 a section was cut through the N end of **E20** in order to observe its survival and details of its construction. The upper part of the wall was well compacted and solid with each layer of the construction quite evident in the form of increasing evidence of compaction from bottom to top. The base of the wall, however, was heavily damaged and not well consolidated at all. This, in fact, appeared only to be supported by the solid eroded talus of finely layered clays and silts which spread out from the base of the wall. Major structural cracks were also seen penetrating c10.0cm in from each wall face. Two of the three post supports at this end of the wall were evident only as the broken decayed points of posts left in the ground. Of the third there was no evidence at all despite a record being kept of its exact location. This raises the question about the survival rate of a series of post which are set fairly shallow and which were not retained in the ground for any length of time due to their use elsewhere in the construction of further sections of wall.

Clay and Lime Plaster.

Analysis of the various surfaces finishes and floors at *Kissonerga* indicate that two types of plaster were being used, clay and lime plaster. The source of these materials was unknown as were the methods used in their production and preparation. Considerations of status, labour input and consumption of resources were important to the whole question of plaster production and will be considered later. The experiments themselves, however, are quite dramatic in their success and demonstrate the process of our own learning abilities as much as they answer questions about prehistoric technologies. By drawing on what little knowledge I had at the time about plaster production and relying heavily on our understanding of prehistoric capabilities and resources a more satisfactory result has probably been achieved with modern concepts of quality control, adherence to procedure and purity of materials being completely disregarded. This will become clearer as the description of the experiments develops.

Clay Plaster

The purest type of soil which was available locally and which had a high clay content was the havara subsoil. Its creamy white colour and fine-grained texture matched well the types of plaster which were detected on the fixtures and walls of some of the *Kissonerga* buildings. Several attempts were made to use this material in various parts of the reconstructions which are described below. As an external finish it was used on the gutters and porch of **RH2** while, internally, it was used more extensively for the hearth and basins of **RH2** and for the first stage of the large mural on the back wall of **RH1**. Apart from the small porch, which has been largely eroded or buried, all these initial experiments have been replaced with lime plaster. The suitability or validity of the experiments has not been called into question by the removal of the clay plasters but it does reflect a pragmatic recognition that unbaked clay cannot withstand the constant pressure of visitor numbers, modern footwear and thoughtless curiosity. Under more gentle conditions of low level barefoot use clay plasters, even on hearths and basins set into the floor, would survive in quite a satisfactory condition to give many years of use. The *Lemba* experiments, from this point of view, have been more than successful.

E10. In **RH2** three different features were constructed out of a havara clay plaster; the hearth, a pot setting and a set of basins on the floor of the building. The hearth was a centrally placed circular platform hearth of type 3 which is so characteristic of most buildings in the Chalcolithic period. It is set in a shallow dished scoop 1.0m in diameter and c0.20m at its deepest which is first lined with a thick layer of moist mud and then packed with fist-sized cobbles to bring it up to floor level. The shape of the hearth was then formed in mud to give the flat platform with tapered sides and a central firebowl. This was finally covered in a 5.0-7.0cm thick layer of the havara plaster. The plaster was made in a ratio of sand:havara:water of 3:2:1.5. This was smoothed over to bring the finer grains to the surface and provide a good regular finish. It was wetted and covered with sacking to dry out slowly overnight.

Some cracking penetrating the hearth to a depth of 1.5cm was evident in the morning but as the plaster was still malleable it was forced together and burnished over to seal the cracks. This continued periodically throughout the day which assisted in drying the surface off and giving a fine smooth finish. The cracks, however, did persist but only as minor splits in the surface of the hearth and did not present any major structural concern. It is apparent that these form during the first few hours of drying and that constant vigilance during that period could have averted most of the damage, minor as it was. The basins, which were to be of type 3, were placed to the S of the hearth and are based on those found in **B7** at *Lemba* and **B1046** at *Kissonerga*. Three adjacent shallow scoops were formed in the floor of the building and lined with mud to give a trefoil shape with slightly raised edges. This was then plastered over with the havara clay. The mixture of havara and water was in a ratio of 4:1 giving quite a stiff paste which was allowed to stand for 30 minutes before being used. The moist paste was heaped onto the basin and then shaped by hand and pounded with a stone pounder into its final form. A smooth flat stone and a wetted hand were used to give it a burnished finish. The pot setting, type 2, was constructed in a similar manner over a socketed stone base set into a hole at the back of the building. All features took several days to dry out and only achieved the characteristic hard, creamy-white appearance after 2-3 months. These survived in good condition for nearly one year until vandalism destroyed the pot setting and so damaged the basin and hearth as to make their replacement necessary. This was carried out in August 1992 two years after their construction.

E23. Prior to its replacement in lime plaster an attempt was made at using the hearth in **RH2** for its true purpose, as a fireplace. Initially, a fire was started in the bowl of the hearth using paper and twigs but this succeeded only in creating a lot of smoke with very little fire and was consequently abandoned. A second attempt at starting a fire outside and transferring the burning embers indoors to light the charcoal was more successful. The fire caught well with very little smoke and fumes after the initial burning to light the charcoal all of which exited by the small smokehole in the roof of the house. Blackening was seen around the firebowl itself but no increase in the cracking of the hearth was detected. A cup of water placed 3.0cm from the firebowl had become lukewarm within 5 minutes and was steaming within 27 minutes. After 2 hours the area within 10.0cm of the firebowl was too hot to touch. Various fuels were used on the fire but most produced such quantities of smoke as to make sitting indoors unbearable. This was particularly true of the dried sheep/goat dung. Tinder dry sticks and wood were considerably better but charcoal was the only fuel totally acceptable to modern eyes and noses. A similar experiment was later carried out on the large square hearth in **RH1** during which a highly satisfactory meal of lamb and pork kebabs[8], bread, and indigenous vegetable salad[9] was prepared and enjoyed in true Chalcolithic fashion. Beer and wine were also consumed in quantity although, strictly speaking, there is no direct evidence for the making of these beverages in prehistory despite the occurrence of both cereals and the grape in the archaeobotanical record.[10]

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[8]Zoological information courtesy of Dr.P.Croft.

[9]Botanical information courtesy of Ms. M.A.Murray.

[10]supra footnote 8.

E8. The roof of **RH2** also saw some attempts at the use of havara plaster in an external setting as a roof covering and in the formation of gutters and drains to channel water off of the roof. A porch was also built at the entrance way to the building. All of these experiments were created at the same time as the construction of the building in an attempt to determine the most appropriate types of materials and finishes for the house. Apart from the porch they have all been removed and replaced with other materials. Each will be described under the section on **RH2**.

E16. A more ambitious plan of experiment and presentation was devised for the interior of **RH1** which by 1991 had developed into the main showpiece for the entire LEV project. The initial part of this scheme involved the recreation of the internal wall decoration represented in the building model KM1446. The rational behind this was not entirely motivated by sensationalism and the desire to create a spectacular visual display, there is adequate evidence from both *Lemba* and *Kissonerga* to know that walls were plastered in clay or lime plaster and were occasionally painted in red ochre as well. The use of the design inside the building model for the decoration of the house wall may be carrying the interpretation further than is warranted by the evidence; after all, the model is a unique vessel and may represent a unique design which may have been used only on certain, or even a single building. We can never be certain of this but, on balance, it is our only model of Chalcolithic interior design and as such was considered worthy of resurrection. As regards the question of scale, there are grounds to suspect that design inside the model may represent a pattern which, in real life, would be much more intricate and detailed but which could not be reproduced on such a small scale with primitive brushes or painting implements. A contemporary analogy would be the house model or dolls house which, despite the advances of twentieth century technology, can still not portray the many details and proportions of elements in a full scale house. But again, we cannot rectify this situation and we must live with the possibility that in **RH1** we have created the Chalcolithic equivalent of a "doll's house" interior[11].

The clay wall plaster and mural were created in the summer of 1991 and retained for one year to observe its durability and comparability to prehistoric plasters.[12] However, as with other experiments on the site, the enthusiastic curiosity of the public was partially responsible for its early demise. It was, accordingly, demolished the following year and replaced with a lime plaster.

The havara for the plaster was obtained from the quarry to the N of the site beside the entrance to the site. This was mixed without the use of any organic addition in the ratio of havara:water of 2.5:1. A total of 158 litres was produced and stored for 2 days to allow complete saturation of the material to take place. This was assisted by regular and vigorous mixing of the plaster in a large oil drum. The dryness of the wall which was to receive the plaster was thought to be problem in that it would absorb the moisture from the plaster too quickly without allowing it to cure properly or to be worked to obtain a smooth finish. Accordingly, three trial patches of plaster were applied. The first of these was applied to a section of wall which had been soaked in water, the second to a section which

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[11]This is a serious observation but, in the absence of *in situ* wall decorations, it is the only plausible interpretation open to us.

[12]The work was carried out by Mr.A.Rees of Edinburgh University as an undergraduate course project in which he was given detailed directions on the materials, techniques and design of the mural but was allowed a free hand in developing its execution. Mr.Rees who initially trained as a plasterer was able to add to our understanding and appreciation of prehistoric plastering.

had been prepared with a modern sealant and the third onto a section of unprepared dry wall. Half an hour after the application all three patches had cracked badly and only the patch applied over the modern sealant had not peeled from the wall. The decision, therefore, was taken by the plasterer that in order to obtain a satisfactory result, sealant would be applied to the entire wall surface. This, of course, diminished the experimental value of the exercise but was carried forward none-the-less in the interests of site presentation. The actual plastering was carried out using modern tools although it was noted that application by hand and smoothing with flat stones was equally effective. The havarra plaster behaved in much the same way as a modern plaster and was applied in layers up to a total of 20.0-40.0mm which were constantly wetted and troweled smooth to produce a fine slip which infilled the finer cracks on the surface. This was carried out twice a day for three days until the plaster had dried out and the cracking had ceased. The design from the building model was then scaled up, drawn upon the wall and painted in using a havara, red ochre, and water mixture in the ratio of 1:4:4. The effect was quite dramatic. Unfortunately, within a year water erosion through the roof, visitor attention and general disintegration had taken its toll.

Lime Plaster (fig. 72-80).

E19, E15. The production of true lime plaster is considered to be an evolved and costly process which has important implications for the organisation of labour within society, the transmission of cultural traits and the consumption of resources. That it did exist in the Chalcolithic period is not in doubt but the way in which it was made and the sort of archaeological deposits which would result were unknown. Modern production demands that the limestone is fired at temperatures of 900^{0}C for several hours in order that a sufficient degree of calcination has taken place to transform the stone into quicklime. There is no evidence from the period of large well-built kilns which would provide a facility for such activity. Fire-pits and areas of general burning are common, sometimes at some distance from the main area of the settlement as at *Lemba*. Could it be that such features were used? The absence of good outcrops of pure limestone near the site also posed a problem and forced our attention to turn to the natural terraces of kafkalla adjacent to the site as a source of raw material.

It was decided that a small-scale experiment should be attempted in order to determine the probability of prehistoric production being on such a low level that few remains would survive. A circular straight-sided, flat-bottomed pit with a diameter of 1.15m and a depth of 0.40m was dug in the S part of the experimental area. A flue 0.25m wide and 0.30-0.40m deep was also constructed sloping to the NW and a second one was cut to the SW due to the change in wind direction during the firing. The kafkalla was quarried from the cliff edge to the N of the site and broken up into fist-sized chunks. A total of 102kg (12 buckets) of kafkalla chunks and powdered material was used in the experiment along with 144kg (18 sacks) of charcoal. A ring of stones along the edge of the base of the pit to allow air circulation contained the main firing material of paper, straw, and sticks. Over this was heaped alternate layers of kafkalla and charcoal until all the material had been used up leaving a dome-shaped structure. A clay capping was built over this with several ventilation holes to provide a through draught although this was later removed as it appeared to hinder the firing of the interior mass. The kiln was ignited at 9:00hrs but took a long time to develop into a good state of combustion which only came about by 12:00hrs after the dome had been removed and more charcoal had been heaped on the top. By that time the whole kiln was alight with a strong glow evident through the gaps and some blackening of the stones occurring. By 14:00hrs many of the stones were turning to powder and a strong smell of burnt lime emanated from the kiln. By 15:00hrs the charcoal had burnt off and the domed shape of the kiln had collapsed. The kiln was opened at this stage. Only a small amount of charcoal was left near the base of the kiln and the stones near the centre had turned green on their surface with a marbled interior. The stones further out from the core were burnt orange while those on the periphery were blackened or grey. The stones of the sandstone ring which had been set along the base of the pit had, surprisingly, not split in the heat. Forty-eight hours after the firing some of the intact kafkalla stones and the few limestones which had been included had started to split and crumble into a white powder. This material was collected into 1 bucket (8.5kg) and retained as a separate sample (A). A further bucket (8.5kg) of the material which had disintegrated during the firing was also taken. This comprised multi-coloured calcined stone and scrapings from the kiln including some charcoal (sample B). More than 68kg of this material was not collected, although it was equally suitable, giving a total of 85kg of calcined stone available for processing.

E15. The A sample was pulverised into a fine powder using a stone mortar and pestle (Chalcolithic) and then added to 4 litres of water to produce a total of 10 litres of slaked lime. Within 20-30 minutes a chemical reaction was evident as the paste turned quite warm. A similar treatment was also given to the B sample which turned hot within a 30 minutes of the addition of the water. These were both allowed to stand for 2 days to ensure complete rehydration had taken place. After that time the mixture was decanted and the scum of water and crystal which had formed on the surface was poured off. The paste of both samples was mixed thoroughly to form a very smooth grey slurry which was then spread in two patches over beds of uncalcined kafkalla on the floor of **RH3**. These were held in position by a low mud ridge. Within half an hour both test areas had begun to set and were smoothed out with a trowel to give a very fine smooth surface. As a control, a paste made up of finely pulverised raw kafkalla mixed at 1:1 with water was also spread out in a similar fashion and burnished to give a good surface (sample C). Within 24 hours all three had set and were quite hard although A and C were still workable. A few cracks which were evident in samples A and B were due to the uneven foundation upon which they lay and could easily have been rectified had more care been taken. Both were beginning to lose their grey colour and adopt a much whiter, cleaner appearance. Sample C, surprisingly, had not cracked but still remained a very buff/brown colour and was susceptible to damage by any contact with water. This experiment was carried out in March 1991 and preserved for a year in place on the floor of the building. By then samples A and B had become very hard blue/grey cement-like floors with no signs of decay or disintegration. In 1992 they were removed and placed on the roof of the building in order observe the effects of weathering. Both samples A and B survived well with no apparent decay for several more years before they were discarded. Sample C disintegrated very rapidly within a few months of exposure.

In April 1992 the kiln **E19** was reopened and a section was cut across its S half to determine the archaeological effects of the firing. The pit had been emptied after the firing removing most of the well fired material from the centre and leaving only a bank of poorly fired stones along the edges. These stones had become "embedded" into the sides making the definition of the edge slightly more ambiguous. There were some signs of reddening towards the centre of the floor of the pit only with the sides being apparently untouched by fire. Roots had grown in from the sides and soil had eroded down into the pit between the stones creating a layer of stones and soil with a matt of organic material along the bottom of the pit. Some of the organic material from the firing, the straw and some twigs, was also still preserved on the floor of the pit beneath a layer of brown fine silts which itself lay below a layer of blackened soil and ash. This appeared to consist primarily of silicates and finely comminuted pieces of charcoal. The existence of these layers at the base of the pit was quite surprising as it gave the impression that the kafkalla stones of the firing were not the primary deposits within the pit but appear to have been inserted after the silting had occurred. As this was clearly not the case the explanation must be that they had rolled there from the bank of stones along the edge of the pit. This, however, still does not explain the absence of any stones in a primary position directly on the floor of the pit in amongst the eroded silts. Clearly the formation of pits and their incorporation into the archaeological record is not a simplistic matter and is worthy of further investigation.

The initial attempts at making lime plaster were quite clearly a success. In the short time of only 3 hours from 12:00hrs to 15:00hrs when the kiln was seen to be most active a substantial degree of calcination had taken place. Temperature readings indicate that the required heat of 900°C may never have been achieved and may have been substantially lower and for a much shorter period than is normally considered necessary.[13] In view of the success of the experiment, however, it was decided that a more ambitious project be undertaken with all stages being carefully recorded. The construction of a lime plaster floor and ridges, hearth and mural in **RH1** and the reworking of the features in **RH2** was, therefore, undertaken during May to June 1992.[14]

E26. Considerable quantities of lime plaster would be required in order to carry out the type of projects which were envisaged. On the basis of estimates for excavated floors alone it was thought that this could run to several thousand litres of floor material. In **B206** at *Kissonerga,* a building with an estimated diameter of 15.0m, floor 744 comprised 3.316m^3 of material of which lime plaster constituted 2.49m^3. **B2** on the same site was 9.5m in diameter with a plaster floor, 389, which comprises 1.60m^3. Over one quarter of this was aggregate making the total volume of lime plaster to be 1.0-1.20m^3. **RH1** at LEV was a building with an internal diameter of 8.50m. The location of the proposed plaster floor in the SE quadrant of the building placed several limitation on its size. The presence of two timber roof posts meant that the floor could not occupy fully one quarter of the floor

[13] In all the experiments with lime plaster making, temperatures in the kilns were measured with a Testlab Digital Multimetre (3600 series). The thermocouple was placed for alternate readings at the edge and at the core of the kiln.

[14] The work was carried out by Mr.A.Rees following clear guidelines and using the previous experiments as a model.

space of the building but including the central square hearth and the radial ridges it was thought prudent to estimate for the full area of that quadrant. There was a slight dip in the floor towards the centre which would be levelled up with the aggregate bottoming of the floor leaving it with an average thickness of plaster of 0.10m. The estimate for plaster needed for the floor, hearth and ridges alone was: $((3.14 \times (4.25)^2 \times 0.10)/4 = 1.4\text{m}^3$. This amounts to 1400 litres or 175 buckets in LEV currency. It is known from the analysis of plaster from *Kissonerga* that a sizeable portion of the plaster was made up of uncalcined pulverised limestone, which is the equivalent of adding sand to modern cement. It was decided, on the basis of trial and error, that the lime putty would be mixed with pulverised kafkalla in a ratio of 50:50. This would reduce the amount actual lime being produced to 700 litres of lime putty or 88 buckets. In the end, even this was an over estimate.

Kiln No.	Kafkalla	Calcined stone	Lime powder	Charcoal	Firing time	Man/hours
1	15 buckets	14 buckets	9 buckets	15 buckets	9-12hrs.	11hrs
2	30 buckets	24 buckets	16.5 bucket	13.5 bucket	9-15hrs	20hrs
3	48 buckets	42 buckets	30 buckets	16.5 bucket	9-15hrs	22hrs
4	45 buckets	42 buckets	33 buckets	18 buckets	30-48hrs	nr.
5	17 buckets	nr.	nr.	18 buckets	40-50hrs	nr.

Table 6. Quantities and results of five firings of the lime kiln. The man/hour totals include the total amount of time required to quarry the kafkalla, construct and set the kiln, supervise the firing and, collect and pulverise the calcined lime before slaking in water. These figures are generally for two people working together apart from kiln no 5. The firing time includes the total time from the lighting of the kiln until it was cool enough to handle. In this table nr. means no record was kept.

The lime was produced in five kiln firings, four in May to June 1992 and one in March 1993. A close record was kept of all the firings and temperature readings were taken on the final firing in March. A kiln was constructed from the remains of an earlier mud mixing pit to the S of the reconstructions and away from any other activity. This consisted of a large pit 3.2m long, 1.5m wide and c0.50m deep. Each firing was constructed with a layer of larger stones set on the base of the kiln infilled with straw and sticks followed by alternate layers of fuel and fist-sized chunks of kafkalla quarried from the terrace edge. In the first firing only charcoal was used as fuel but all subsequent firings used roughly the equivalent volume of wood apart from kiln 5 which used half the volume of wood. The firing took place in the morning when a suitable wind draft had developed, usually around 9:00am, reaching a peak of incandescent heat around midday and tailing out over the afternoon. A strong smell of burnt lime was noticed during the afternoon. The first two firings were the smallest and were completed by the end of the day with the kiln being opened the next morning. The latter three firings were each about double the size of the first two and characteristically took much longer to cool frequently being too hot to approach for 48 hours. The material from the first four kilns was used in the construction work inside **RH1** while that of the fifth was used for the renovation of the **RH2** walls and features. In the following table a bucket is equivalent to 7-8 litres of fluid volume or an average of 8.5kg of weight when holding stone.

In these experiments the tremendous variation in firing time was dependent on the prevailing weather conditions with warm still nights leading to much longer cooling off periods while even moderately breezy evenings could reduce this considerably. The temperature record for kiln 5 shows that high temperatures, over 600^{o}C , were sustained only for 4-5 hours at the heart of the kiln within a couple of hours of the start of the firing (table 5-6). Evidently the larger kilns retained their heat for much longer making access to them impossible for several days but the actual intensity of the burning when calcination would have taken place was virtually the same for all kiln sizes. The quantities of fuel consumed are also quite surprising. Large amounts of wood were not used in the process although the estimate of totals is made difficult by using a combination of wood and charcoal. In terms of volume the ratio of charcoal to wood was 1:1. If it is assumed that the production of charcoal retains roughly the original volume of the wood and that what is mostly lost is the moisture content then this ratio is useful. Volume is probably the more useful measurement of comparison considering the differences in weight between stone, powder and charcoal. Of the kilns which used this ratio, kiln 2 fired 30 buckets of kafkalla with 27 buckets of fuel, kiln 3 fired 48 buckets of kafkalla with 33 buckets of fuel and kiln 4 fired 45 buckets of kafkalla with 36 buckets of fuel. This is slightly below the estimated amounts required by modern standards of lime production which stipulate equal quantities of fuel and limestone. It is evident that in the LEV firings the calcination was not complete throughout the kiln but was confined mainly to the centre and was controlled by the prevailing weather conditions. Stones near the centre of the kiln were always very well burnt and in a state of disintegration while those further out toward the edge were burnt orange/green and decayed if left in the open air for a day or two. They had evidently undergone some calcination which did not become apparent until recarbonation through contact with the air had begun to split the stone apart. Stones along the edge of kiln were poorly calcined and were often unsuitable for incorporation into slaking process. The relative proportions of kafkalla stone to calcined material indicate, however, that this loss was not very great. Neither did the presence of partially calcined material affect the quality of the final product which produced a good lime putty and which probably benefited from its inclusion as a natural inert filler.

	0 hr	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	7 hr	8 hr
core	0	740	880	880	740	600	680	460	740
edge	0	600	680	680	680	540	450	400	400

Table 7: Temperatures in ^{o}C reached during the firing of one of the kilns during lime plaster production. The temperatures were recorded over an eight hour period at both the core and the edge of the kiln. After 24 hours the temperature at the core was still 450^{o}C.

After the kiln had cooled down the calcined and partially calcined material was removed and laboriously pulverised in a stone mortar using a stone pounder which appeared to be the most effective method. This was a very time consuming process which, on average, took about 15 minutes per bucket of collected calcined material. It was also mildly hazardous with eye protection, face masks and gloves being worn to avoid the effects of the slightly caustic dust. A relatively still environment was also recommended in order to prevent the spread of the dust by gusts of wind. The lime powder was then stored in large oil drums which contained water to create a lime putty.[15] This was left to rehydrate over 6-10 days with care being taken to keep the putty covered with water and protected from contact with the air. A total of 630 litres (90 buckets) of lime putty was produced in this way from kilns 1-4. Before being used the lime putty was mixed with powdered kafkalla in the ratio of 1:1 during which further water was added at the ratio of 1 bucket for every 6 buckets of the lime putty/kafkalla mix. The kafkalla acted as an inert filler and, with the paste, produced very smooth easily worked plaster quite similar to modern materials. It was used immediately upon mixing as the lime putty base would now be exposed to air and the carbonation process would start to cause the mixture to harden. By this stage, however, the initial preparation of the hearth, floor, ridges and wall render must have been complete.

E27-30. The sort of hearth and floor which was envisaged for the interior of **RH1** was of the type seen only in the large period 3b houses at *Kissonerga*, specifically from **B2**, **B4** and **B206**. Although similar arrangements were also found in period 3a houses, these were not plastered over with lime plaster and would not have survived the pressure of visitor number at LEV. A further plaster floor can also be seen in the adjacent excavations at *Lemba* in **B4** although, this is not as well preserved as the *Kissonerga* examples and lacks the central hearth and ridges. The pattern of the features for **RH1** were first laid out on the floor with string in order that the surface within that area be cleared and levelled somewhat to produce a more regular foundation. A large square type 3 hearth 1.5m x 1.5m standing above the floor by 0.15m was to be located beneath the central smoke hole. This was to have a small central firebowl and was modelled on the best preserved example, hearth 951 from **B855** at *Kissonerga* which produced complete structural details. Radiating from the two easternmost corners of the hearth and extending to the wall inside the area defined by the two roof posts low type 1 ridges 0.25m wide and 0.15m high were to be constructed. Their details were based on ridges 1572 in **B1547** and 1567 in **B1565** both at *Kissonerga*. Although there is no archaeological evidence that these types of ridges were ever plastered it was thought prudent to do so in the light of the anticipated heavy use of the structure. The floor was to be of a type 4 plaster floor set on a bed of fist-sized cobbles between the two ridges.

The hearth and ridges were constructed as one feature with the ground first being cleared and their shape being laid out with pegs and string. This was also used to control the height of the features and the slope of the floor. Selected cobbles and stones were used as the base of the features and were held firm with a mud mortar 2-5cm thick. The shape of the hearth and ridges was then created with mud and finished off with a bed of small graded stones which were battened down into the mud using a large flat float.[16] Sherds collected from the LAP spoil sherd dump and saturated in water were then embedded into the surface of the hearth and covered with a thin plaster slurry which was also poured over the ridges. The following day the features were covered in a thick layer of lime plaster which was smoothed out using a large flat float and finished off with a steel trowel. A very fine, smooth finish was achieved with this method which was improved by burnishing on four occasions with a flat

[15] The lime powder was always added to the water rather the other way round which could, potentially, be mildly explosive.

[16] A float is a rectangular piece of wood or plastic with a hand grip on one side and is commonly used by plasterers to hold a lump of plaster in one hand while applying it with a trowel in the other hand.

pebble. The cracking on the ridges was minimal hairline cracks which were quickly burnished away over the next day. There was no damage or cracking to the hearth during the setting of the plaster. This work was carried out largely by one person over two days and incorporated the following materials: 66 buckets of mud, 24 buckets of stones, 24 buckets of plaster, 3 buckets of sherds and 2 buckets of small stone chips.[17] In total, 12 buckets or 84-96 litres of lime putty was used.

The area of the floor had now been defined and was further levelled, the material being kept to make the mud to support the bottoming. A pavement of cobbles and partially calcined stones from the kiln was laid in a bed of mud in the space between the two plaster ridges. The slope of the floor meant that a greater depth of several layers of stone was established near the centre of the room beside the hearth (c0.10-0.15m) while the edge of the floor at the wall was only one course deep (c0.05m). This was heavily compacted using a large steel ramming pole although a large stone pounder would have been equally efficient but would have involved more back-breaking labour. The cobbles and stones were wetted and the plaster floor itself was laid over this foundation being built up in several layers which were finished off at each stage with a large float. The final surface was given a more thorough treatment with first the float and then a metal trowel to produce a very fine, hard, smooth plaster floor. The was no cracking, subsidence or any other damage to the floor during the setting of the plaster or, indeed, during its subsequent use. The quality of this floor and of the hearth and ridges bears favourable comparison with modern surfaces of plaster. It has the hardness and durability of any floor made from such materials and is almost as good as modern cement for low level use. The entire process of laying the floor from the foundation to the final surface took one person, with occasional assistance, one complete day of c10hrs. As with all plaster work, it was necessary to complete the laying of the plaster in one episode in order to avoid seams or joins which may emerge as points of weakness making it vulnerable to cracking or erosion. The total amount of plaster used was 66 buckets of which 33 were lime putty.

The mural which had been created on the back wall of the building the previous year was completely removed and most of the wall surface was covered with a mud render extending from the E door jamb around 3/4 of the interior of the building. The thickness of this render varied with the irregularities of the wall and was applied in order to create a regular smooth surface with a gentle slope at the base of the wall onto the floor. It was on average 5.0cm thick increasing to 10.0-15.0cm thick at the intersection with the floor. While the render was still moist a plaster surface c1.0cm thick was applied over the entire area leaving only one section uncovered to show the underlying render. Above the area of the plaster floor the wall plaster and floor plaster were merged together in a gentle and continuous slope. The design of the mural from the interior of the building model was then recreated on the back of the wall using a red ochre/havara/water paint. The paint was absorbed very well into the plaster and still survives in a pristine condition several years after being created. The total amount of plaster used on this wall was 12 buckets of which 6 were lime putty. A similar treatment was afforded the interior wall of **RH2** with a layer of render and plaster covering most of the wall surface. Only a

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[17] For these purposes, 1 bucket of soil/plaster = 7-8 litres, 1 bucket stone/sherds = 8.5kg

short stretch behind the door was not covered in order to leave a part of the wall structure exposed for inspection. The hearth and basins inside the building were also given a lime plaster covering over the original clay plaster to provide a more durable finish. This work also absorbed 12 buckets of plaster of which 6 were lime putty.

The amounts of lime plaster needed for the various projects had been fairly accurately gauged and incorporated a certain amount of flexibility in the amounts of havara powder which was added as an inert filler. The adoption of a 50:50 mix was a sensible and valid decision although it is possible that even larger quantities of havara could have been included without jeopardising the outcome. In the end 89 buckets or 712 litres of lime putty was produced and 57 buckets or 456 litres was used in the construction. The loss of an entire barrel of lime putty (58 buckets) which was allowed to dry out during slaking accounts for the difference. The exact amounts used are as follows:

Element	Lime plaster	Slaked lime putty
Hearth & ridges (**RH1**)	24 buckets	12 buckets
Floor (**RH1**)	66 buckets	33 buckets
Wall plaster (**RH1**)	12 buckets	6 buckets
RH2 wall, hearth & basins	12 buckets	6 buckets
Total	114 buckets (912 litres)	57 buckets (456 litres)

*Table 8: Amounts of lime plaster and slaked lime putty used in fixtures in **RH1** and **RH2**.*

4.3 The Reconstructions.

To date, five buildings have been constructed at *Lemba*. They have been deliberately built in close proximity frequently covering or obscuring previous features of the experimental site in an attempt to replicate the natural development of a village setting. The form of these buildings is based directly on interpretations of excavated archaeological material from both *Lemba* and *Kissonerga* and has largely been under the control and direction of the writer with the exception of **RH1**. However, several features have appeared in some of the buildings largely through the imagination and logic of the builders and do not necessarily have any specific archaeological grounding. The roof details of **RH1** and the particularly deep foundation cut for **RH4** are such instances. These do, unfortunately, detract from the experimental value of the buildings but can be justified as controls to demonstrate whether or not such features could have existed. Several building types have been recreated and attempts are being made to remain faithful to these types with only those features, materials or techniques known to be associated with them archaeologically being incorporated within their structures. This, however, has not always been possible due to the open policy of the project which allows unlimited visitor access and precludes the construction of some of the more fragile or moveable aspects of Chalcolithic housing. This is particularly true of the remodelling of the features and walls inside **RH2**.

Roundhouse 1 (fig. 81-89).

The first reconstruction was carried out from October 1987 until June 1989 during which time the main structure was completed.[18] The internal features were executed after that time and have been described above. The timing of this construction was perhaps unfortunate in that it was undertaken before I had been able to carry out any real research into the detailed evidence available for building elements. However, enthusiasm for the project from other members of the team carried through the debate with the result that **RH1** came into being. With hindsight, it is possible to see that the building is ill-conceived in several aspects and would not be constructed in the same manner if a similar project was to go forward at this point. However, this is the nature of experimental archaeology and by teaching us lessons in building design and materials use it has been a success. In the end, although there was a suggested design proposal, much of the work relied heavily, not so much upon archaeological evidence as upon the logic and practical skills of its builder. The result is a building constructed to the best levels of the abilities and expectations of modern western society. Whether this also applied in prehistory is not known. The size of the building was also, in hindsight, overly ambitious. With an external diameter of 10.0m we can now look with appreciation at the sheer scale and mass of the structure. That we did initially conceive of such a large building probably reflects our perceptions of prehistoric houses at the time with such a structure being thought of as a modest, unimpressive affair. The alteration of that preconceived attitude is probably the biggest contribution made to research by **RH1**.

Background. The sort of evidence which was used for the design of the building was drawn very largely from the prehistoric buildings which stood before it at *Lemba*. In particular, **B2** was viewed as the most appropriate model for the general layout and groundplan of the structure. The foundation, stone wall base, internal postholes, doorway arrangements and diameter are all based on that building. However, **B2** at *Lemba* is a LChal structure which on the evidence now known from *Kissonerga*, would more probably have been characterised by a type 4 stone built wall and not the type 3 MChal mudwall which has been used. Lime plaster, which has also been used heavily in **RH1** for the square hearth, radial ridges and wall mural are all MChal features which do not sit easily in a LChal type building. In particular, the position of the postholes which is confirmed by the evidence from **B2** interferes with the layout of the large plaster floor which in MChal buildings is free to occupy fully one quarter of the entire structure. What has been created with the roundhouse is a hybrid which never existed in prehistory. However, as a showhouse and as a laboratory in which to carry out various test experiments, it is ideal.

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[18] The majority of the building work was carried out by Paul Croft of the Lemba Archaeological Project. As the construction ran over several excavation seasons there was periodic assistance from site volunteers, particularly with the building of the mud walls. A few of the more enthusiastic diggers also stayed on past the excavation season to help with the later stages of the work on the roofing. A retired workman from Lemba village with past experience of traditional mud buildings, Mr Panayiotis, was hired to help with the rendering of the walls during which time he gave much valuable advice. The overall design and specifications for the building were laid down by myself although many of the details were evolved by Paul Croft as the work progressed. Paul's skill, craftsmanship and determination in tackling such a large construction are impressive.

Several designs and proposals were put forward for the final format of the building. Once it had been decided that the building was to be constructed in mud based on the layout of **B2** at *Lemba* the main difficulty was in determining the type of roofing which was to be constructed. Initial views favoured a conical timber and thatch roof much like those seen on African houses and replicated in N European reconstructions. However, it quickly became evident that such a massive roof could not be supported without a greater number of internal posts than is warranted by the evidence, even if the walls were made to carry most of the weight. A domed or tholos type roof as proposed by Dikaios for aceramic Neolithic buildings was also vaguely considered but again rejected through lack of evidence and the daunting task of having to construct such a formidable structure. On the basis of the meagre evidence which did survive at that time in the form of possible mud roof fragments, and by comparison with traditional Cypriot buildings a flat earth roof resting on timber rafters and supported on timber upright posts set into the ground was accepted as the most likely type of prehistoric roof. Various patterns of timber arrangements were investigated and it was decided to opt for a simple radial arrangement rather than more complicated systems of tangential beams. The rafters were to rest partly on the wall head and partly on ring beam set on four posts near the centre of the building and were to support layers of organic material forming a dense mat upon which the soil and havara was to be laid. This decision to build a flat earth roof was to be fully justified by later discoveries at *Kissonerga* and at *Mylouthkia* although the pattern of timber support may now be open to review. Details of the stone plinth construction, doorway arrangements, orientation and wall treatment were forthcoming from excavated buildings and from the building model <u>KM1446</u>. The height of the building was estimated from the minimum requirements for access within a building to materials stored in pithoi situated at the edge of the room space. This was set at 2.0m max. including plinth, wall and roof. In the end this building was constructed considerably higher and now stands 3.0m high at the centre although the amount of actual internal roof space is 2.5m. The overall height from the base of the walls to the top of the roof is between 2.60-2.75m. Although this cannot strictly be justified, it does give a much better proportion to the building and a greater feeling of spaciousness. In the absence of any real evidence for wall heights the one adopted for the building is as valid as any other and on a much more human scale. The inclusion of a window within the building was based on feature 492 in **B3** at *Kissonerga* which was interpreted by the excavator as the blocking of a window which had collapsed into the building during its destruction. There are a number of reasons which make this a very feeble proposition, not the least being that such a poorly constructed blocking would not survive well and would certainly not survive the collapse. Its location in the building collapse would also have placed it in an awkward position either above or very near the door greatly adding to the structural weakness in that area. Despite these considerations it was decided that a window should be inserted in the reconstruction. Its exact position was dictated by the expedient that, at the time, the E arc of the wall was the only part still low enough to receive a window without necessitating some demolition. It proved to be a suitable location by providing light and ventilation over the area of the future plaster floor, the formal part of the new house.

Foundation and Plinth. **E1**. The location of the building at the rear of the site of *Lemba* placed it on a section of ground gently sloping from the terrace on the N to the field on the S. This effectively meant that the foundation of the building had to be cut into the slope on the N and terraced out on the S. The builder made the decision not to quarry out the entire area of the proposed building as this would require considerable effort and would remove soil which could be quarried gradually and used for mud as the walls were being built. Instead, a trench 1.10m wide and 0.50m deep with a 5.20m radius was dug along the arc of the wall in the N and E to accommodate the wall footings. This was later increased slightly to allow suitable space for building to take place. The land surface to the S and W were, in contrast, built up by c0.25m with material taken from the trench. This effectively created a type 2 foundation for the building with the soil which was left in the NE of the building area gradually being removed during construction and later experimental work inside the structure.

The stone plinth was to be constructed to give a 10.0m diameter building and was to be built in roughly finished limestone and calcarenite blocks set as inner and outer facing stones with a rubble core of cobbles and mud. It was to be 0.70m wide and 0.35m high. The stone used in the construction was obtained partly from old excavation spoil dumps but also from an old terrace wall lying to the W of the site which itself most probably used stones ultimately derived from Chalcolithic houses. Initially the mud mortar for bonding the stonework and creating the mud core was mixed laboriously with water and straw chaff. This was later made easier by the simple expedient of placing the sorted soil into the wall in a dry state and puddling it with water *in situ*. Care was always taken to ensure that larger pebbles had been removed as these could often interfere with the positioning and laying of the larger facing stones. As a mortar it was also deemed unnecessary to include any straw chaff as a binding agent and so was excluded. The stones were frequently trimmed to shape and tapped into place using a modern steel stonework's hammer. A plumb bob was used to ensure the regularity of the sides of the plinth and to determine the level of its top while the stones were correctly positioned by using a tape measure pegged at 0 in the centre of the building. The height of the plinth was found to be within 0.07m between the E and W sides of the building after completion of the work and was considered to be well within accepted levels of tolerance.

An entrance way was created in the SE of the circuit of the plinth 1.20m wide on the external face with right angle door jambs giving an internal door width of 1.0m. The threshold was paved with flat stones set in a layer of mortar at a level of 0.10m above floor level although erosion of material now means that this distinction is no longer apparent.

If the wall is taken to be 30.0m in length allowing for the door way ((2 x 3.14 x 5.0m)-1.2) and the plinth stands 0.70m wide and 0.38m high then the total volume of the plinth is (30 x 0.70 x 0.38=) 7.98m^3. This comprises 260 wheelbarrows of stones and 130 wheelbarrows of soil or mud or a total of 2340 buckets of material. Attempts were made to estimate the weight of material used by two methods. The first was based on average figures derived from weighing buckets of different materials and multiplying this by the recorded amounts of materials used in the construction. Under this method, if each bucket weighs 8.5kg then the total weight of the plinth is 19890kg or 19.89 tonnes. These figures are, of course, inexact, as each wheelbarrow load of material was not weighed which would most surely show a greater variation than is reflected here. However, on average, the figures of 8.5kg per bucket and 6 buckets per wheelbarrow give an idea of the amounts involved. Much lower estimates were reached by the builder who calculated 1.5 tonnes per cubic metre reaching a weight for the plinth of just under 12.0 tonnes. This was the second method. The real figure is thought to lie somewhere between the two, however, the great variation of nearly 8 tonnes between the two figures does call into question the value of such estimates. Considerations of volume are, therefore, thought to be more objective by virtue of being able to generate such figures both before and after the construction work has taken place through measurements which are accessible to anyone who cares to take them. Estimates of time are much more reliable and are based on day books kept by those working on the project. A total of 29 man/days was involved for the construction of the terrace and the plinth.

Mudwall. **E2**. Based on the experiences of the experimental stretches of mudwall the construction of the main wall of the building was undertaken starting in April 1988 reaching completion in June of that year. It was found to be possible to mix the mud in batches of 18 wheelbarrows (108 buckets) of soil to which was added 1-1.5 sacks (3-4.5 buckets) of straw or seaweed and c27-30 buckets of water. The soil was quarried from old spoil dumps on the site and was very roughly sorted in the wheelbarrow before being transported to the mixing site. The use of a coarse 1.0mm sieve was employed by some of the work force to facilitate the sorting of the larger elements from the soil. These were removed for safety reasons as part of the mixing process involved treading barefoot in the mud to incorporate the plant material and to break down the drier clasts within the mix. This was mixed thoroughly with a shovel to turn the mixture and a mattock to break up any clods or consolidated mud. The plant material was then trodden into the mud while still in a fairly liquid state and left overnight to be mixed thoroughly again the next day before laying. Mixing was undertaken immediately to the W of the reconstruction closer to the source of the soil but was later moved inside the building as it was considered far easier to transport dry soil than wet mud. The mix of 18 wheelbarrow loads of soil was generally sufficient to complete a fifth of the entire course of the wall.

By the time it was ready for the laying the mud had achieved a fairly solid, cohesive texture which was still very manageable and could be dug out using the hands only, although a shovel was commonly used. The top surface of any preceding layer of mud was thoroughly wetted before the next layer was added in order to ensure a better cohesion between the two. The mud was then heaped up in horizontal layers of c 15.0-20.0cm thickness and worked roughly into shape by hand. It was then kept in alignment using a plumb bob and finished off with a metal builders trowel. Fist-sized stones and cobbles were finally incorporated into the top of the newly laid layer and left projecting as a further key for the next layer and to help deflect any cracking. The layer was then left to dry out quite thoroughly before the next layer was added. This commonly took one day during the spring and summer months although experience has shown that it can be a considerably longer time during wetter or cooler weather when 4-5 days was not uncommon. The core of the wall took much longer to dry but, by virtue of the longer drying process, experienced little shrinkage and cracking and was much less damaging to the integrity of the wall than was the rapid drying of the first 10.0-15.0cm of the surface.

The wall was built to a height of 2.0m overall from the base of the plinth to the wall head. It consisted of 8-10 mud courses which formed a very distinctive pattern on the wall face in which the division between each lift or layer and the regular vertical cracking was clearly visible. These gave the appearance of a wall built of very rough, but regular mud blocks. This belied the strength and solidity of the wall which surprised all those involved who expected a much less robust structure. The doorjambs were also formed in mud with no additional stonework or strengthening being added. The lintel of the door was made from several posts of seasoned wood laid horizontally in mud across the wall head at a height of c1.80m. Rows of small pebbles were set between the logs in order to prevent the overlying layers of mud from eroding down between the gaps. The window was similarly constructed in the E wall at 1.0m above floor level and 0.75m square at its internal dimensions.

The preparation and construction of the mudwall took 57 man/days of labour and consumed 926 wheelbarrow loads (5556 buckets) of soil, 80 wheelbarrow loads (480 buckets) of stone, c205 buckets of straw and seaweed, and c1300 buckets (c11000 litres) of water. The total volume of the mud part of the wall is c35.0m^3.

Central Posts and Ringbeam. **E3**. The roof of the building was to be supported on 16 equally spaced radial beams resting, at one end, on the wall head and, at the other, on a square ring beam held up by 4 timber posts. The posts supporting the corners of the square ring beam which was 3.0m square and centrally positioned within the building. Each of the 4 elements of the ring beam were to support 4 of the equally spaced radial beams and to be located in such a way that each of the corners of the ring beam fell midway between two of the radial beams. Two of the posts were positioned along a line which bisects the door way and runs through the central point of the building known as the axial line of the building. This successfully organised the radial beams in such a way that none rested directly over the door way, a significant point of weakness in the wall circuit.

The postholes to receive the timber uprights were dug as vertical sided, circular pits 0.70m in diameter and 0.70m deep. All the timber employed in the construction was debarked using a steel axe in order to reduce the risk of damage caused by insect infestations which live under the bark. The trunks which were used as the posts were large pine trees of 0.40m diameter which were rolled into position on log rollers and then upended into the postholes. The gaps around the posts were packed either with stones rammed into place and consolidated with liquid mud or with stones at the base and rammed moist soil for most of the packing. The first method was applied to the SE and NW posts and the second method to the SW and NE posts. Both methods resulted in vertical, secure posts.

The four spans of the ring beam were 3.5m length (dia. c.0.30m)[19] pine trunks which were jointed together at their ends in a log cabin join and then drilled and pegged into the timber uprights. The ringbeam was cut and assembled on the ground in order to determine the height to which each of the upright posts should be cut. This was set at 2.5m above floor level. A power drill was used to drill

[19] All diamtres given are taken at the thickest end of the timber.

the holes through the ring beam and into the uprights. The pegs, of olive wood, were oiled and hammered into place quite easily. In retrospect, the use of forked timbers to support two of the elements of the ring beam with the other two laid across these would have been easier and, probably, more authentic. However, these types of timber were less easy to come by and were not considered in the first instance.

Roof and Wallhead. **E3**. The 16 radial beams, or rafters, were smaller trunks of pine trees (dia. c.0.25-30m) all c5.0m in length. They were manoeuvred into position through the efforts of three people to rest on the wall head and on the ring beam leaving a smokehole of 1.0m in diameter at the centre. Planks of wood were first laid around the top of the wallhead in order to take the weight of the rafters and distribute it more evenly along the wall. When the rafters had been positioned the wallhead was further built up with another course of mud to secure them. These boards measure 1.50 x 0.30 x 0.02m. and were of the type of ordinary boards used in builders scaffolding. This was done as a precaution against undue pressure being exerted on any one part of the wall and could equally have been accomplished by using lengths of timber. The rafters were secured at the other end by notching them into the ringbeam to a depth of 2-5cm using a steel axe. The thicker ends of the rafters rested on the wallhead and projected beyond the wall for c0.40m which was later used to construct an eaves overhang.

A series of smaller crossbeams was laid spanning the rafters in roughly concentric circles. These ranged in size from 2.1m at the wall head to 0.20m near the smokehole and were generally straight branches of pine of 5-10cm diameter. The crossbeams of each alternate bay were set into shallow notches in the rafters to prevent them from rolling, whilst the crossbeams of the intervening bays were lodged in place behind these notched in ends. In total, 16 concentric circles of crossbeams were laid down to the wallhead which was then raised to that level by the addition of a final course of mud. Further crossbeams were also added to span the gap between the projecting rafters to create the eaves. An estimated 256 lengths of crossbeam were incorporated at this stage. Further lengths of branches were laid at right angles to these radially around the roof of the building spaced about 20.0cm apart with about 10-12 being laid along each bay. Over this was laid a dense coverage of myrtle branches cut from several thickets located in an area just inland from the village of *Kissonerga*. The branches were 0.50-2.50m in length and were laid on the roof as flatly as possible. This was in turn covered with a thick layer of seaweed (poseidonia) which, when compressed, was 2.5-5.0cm thick, a depth thought to be sufficient to prevent any soil trickling down through the roof.

Advice from local villagers suggested the use of the white marly soil known as havara for the soil component of the roof. This was of a high clay content and was used extensively in the past before the advent of modern cement construction. It was obtained from the vicinity of *Mylouthkia* where quarrying was taking place rather than using the *Lemba* subsoil which would create a dominant feature on site. It was advised that 5-10cm should first be spread on the roof and trodden down while still in its naturally moist condition before a further 10cm was added and similarly trodden down. Some additional dark soil was also added over the wallhead to raise the level. The eaves were initially finished in a single layer of stones set in mud along the outer edge. This was later completely rebuilt in stone. The inner edge of the roof around the smokehole was finished off in mud and a canopy was constructed over this smokehole. The entire roof was designed to be 0.35m higher at the centre in order to develop a slight dome to the structure and facilitate the runoff of the rainwater without providing too steep a slope.

In total it took 43 man/days to complete the roof and all the timberwork. In materials this consumed 4 large pine posts, 4 ring beams, 16 rafters, 256 crossbeams, 600 small branches, 47 wheelbarrow loads of mud and dark soil, 12 wheelbarrow loads of stone, and 242 wheelbarrow loads of white soil/havara.

Render. **E5.** The exterior wall face of the mud wall was to be rendered with a mud or clay finish and for this task a local retired tradesman was hired to advise and help with the work. The soil used was derived from material eroded off the field above the terrace to the N of the site and was considerably redder than that available over the rest of the site. It was also finer and had a higher clay content. This was most like the red/brown soil type which is characteristic of this area where it has not been disturbed by agriculture. The soil was sieved through a 1cm mesh before being mixed thoroughly with water. Large amounts of plant material were then added to the mix in the ratio of about 1 part straw to 7 parts soil. This was trodden into the mix which was then left to mature for 7 days during which time it was mixed daily and more water added when necessary producing a very mature, plastic and cohesive mix which was easily workable. The actual application of the render to the wall required some experience and even taxed the skills of our assistant who had worked with the material as a young man. The wall face was first thoroughly soaked and the render applied over this 7-15mm thick using a bricklayers trowel. Once the render had begun to dry, typically within an hour, and cracks had begun to open up a further more dilute coat of the same material was brushed vigorously onto the surface filling in the cracks and, to an extent, dissolving and restructuring the entire surface. This was repeated on several occasions over the next few days until finally only water was used to brush over and seal the surface. The final result was a good quality render which, although crazed with many tiny cracks, was very stable and adhered well to the underlying wall. It also survived in a remarkably good condition the storms over the next few years before it was finally replaced by a similar render.

Door and Window. Both the door and the window shutter were constructed in a similar fashion from pine logs and seasoned pine boards. The door consists of 4 planks measuring 1.88 x 0.30 x 0.25m attached together vertically by 2 section of split pine logs to which they have been doweled and glued. One end of each of the split logs is mortised into a door pivot post which is sited in a socketed stone set inside the doorway against the W door jamb. It is held in position at the top by a bracket which has been fixed to one of the radial rafters. The window shutter was constructed in a similar manner but rests on a supporting bracket built into the wall and another secured to one of the rafters. The other internal fixtures and arrangements have been described earlier. The exterior of the building was embellished with the same sort of decoration as was the interior, again based on the exterior decoration of the building model KM1446. Initially, this was applied as a test area on part of the exterior only using a red ochre and havara paint. Its success and impressive appearance encouraged the re-application of the decoration on a grander scale over much of the S and W of the structure using the same type of paint but with the addition of a PVC sealant and stabiliser. This has further added to the stability of the render on that part of the building although it has reduced its value for experimental purposes.

Time and Materials. The total amount of time estimated by the builder for the construction of **RH1** comes to 140 man/days for the actual building work and takes no account of the time taken for acquiring any of the materials. If the quarrying, cutting of branches, collecting water and stones, and transportation of materials is included then the figure would be much higher. However, by not including these aspects the builder quite rightly limits his estimates to those tasks which can be compared reasonably to prehistoric practice. The amounts of materials used are impressive and indicate something of the scale of the project.

Element	Water (litres)	Soil (buckets)	Stones (barrows)	Organics (sack)
Wall- plinth	12,600	780	260	none
-mudwall	18,520	5556	80	696
Roof- edge	600	270	12	24
-surface	none	259	none	none
Render	500	180	none	12
Total	22,220	8340	352	732

Table 9: Amounts of materials used in the construction of RH1.

Roundhouse 2 (fig. 90-102).

The second reconstruction was undertaken during April-May of 1990 and was accomplished entirely by two people.[20] The type of reconstruction was designed to carry forward the work of the previous building and to attempt a slightly different style of building based on information and ideas about the buildings that existed in prehistory. It has always been suspected that all Chalcolithic buildings were not constructed in exactly the same manner. There are obvious differences between the periods in both the scale and materials of the buildings as well as some quite significant differences within periods. It is known, for example, that timber structures existed side by side with mudwall or stone built houses in period 4 and the during period 3 both circular and rectilinear buildings were in fashion. With **RH2** an attempt was made to replicate one of these other building types by creating a

[20]The work was carried out by myself with the assistance of George Findlater of the University of Edinburgh. This involved all the collecting, preparation and construction from start to finish. The timing of the work was deliberately set in order to exclude any enthusiastic help from excavation volunteers and to assess the abilities of two people and the man/hours needed to carry out such a construction. The design and specifications for the building were laid down by myself. My grateful thanks are due to George for his help with the reconstruction.

period 4 stonewall house. New information was also forthcoming about roof construction which could now be incorporated into the new building.

Background. A study of the different types of walling used in the buildings at *Kissonerga* had revealed quite a marked distinction between period 4 and the earlier periods. The walls were much less regular and incorporated a much greater amount of stonework within them. Several buildings survived to a much greater height than was previously the case and it became apparent that they may actually have been built almost entirely in stone or in a combination of mud and stone. This is the type 4 wall of which **B3**, **B834** and **B1056** are the best preserved examples of this type of construction and which provided a suitable model upon which to base the reconstruction. Doorway position had also altered since the previous period with less regularity of orientation being noticed and buildings appearing to group around common areas. This is quite apparent in the group of buildings **B2**, **B3** and **B7** at *Lemb*a itself as well as in the *Kissonerga* group of **B834**, **B1056** and **B1044**. These types of buildings are also characterised by a very distinctive entrance arrangement with pivot stone, thickened door jambs and a quernstone set upright into the floor just inside the doorway forming a type 3 entrance way. Other internal arrangements include the circular platform hearth, type 3, as well as basins and storage installations of various sorts. The type of floor of clay or earth, type 2, and clay plaster wall finish, type 3, which are also characteristic of this class of building were attempted but were considered too fragile to survive the pressures of visitor numbers. Some of these features and fixtures have been described above under the various experiments with clay and plaster. A study of the various types of building materials found within excavated buildings of *Kissonerga* had also greatly added to our knowledge of the form of roofing which existed in prehistory.[21] It was becoming increasingly clear that flat roofs resting on either reeds or very regular long branches and constructed with at least the initial layer in mud were commonplace. The publication of the *Khirokitia* roof (le Brun, 1989) also added weight to this format as a viable prehistoric design and tied in very nicely with an interpretation of the KM1446 building model projections as representing broken roof timbers.[22] An overall design for the building was therefore developed based on existing evidence. A small circular building of 5.0m diameter built with a mud and stonewall and an entrance facing NW was to be erected to the SE of **RH1**. It was to have a flat earth and mud roof resting on reeds supported by rafters running the length of building from NW to SE. The width of roof to be spanned was too great for the available timbers to bear the load easily and so it was also decided that a ridge pole be inserted half way along the building to support the rafters. Initially, two upright forked timber supports sitting on socketed stones were to be added for additional support but the ridge pole proved to be sufficiently large to bear the entire weight and so they were omitted. Plaster guttering and drain spouts were also to be included in the roof to determine their effectiveness and to investigate alternatives to the eaves overhang of **RH1** which was creating problems with the roof. Work on the building using this design was started in the summer of 1989

[21] See discussion under building materials in 3.3 above.

[22] See discussion in 3.4 above.

during which the foundation was dug and the first courses built but the majority of the work was carried out during 1990.

One final specification of this reconstruction was the use of as few modern tools during the construction process as possible. Trowels, plumb bobs, dumpy levels and metal tools were excluded from the site in the belief that these types of tools could have a direct bearing on the outcome or form of the building. Other pieces of equipment such as shovels, buckets, plastic water containers, and wheelbarrows were permitted as these were merely replacing tools or equipment which must certainly have existed in prehistory and hence their use would not affect the way the building was constructed. It was proposed that wall heights and levels be kept regular by reference to the horizon over the sea and that the wall sides be kept vertical by constant visual attention and vigilance. Quarrying of the soil and mixing of the mud was carried out with modern shovels but its application to the walls or as a mortar was done entirely by hand. It was also hoped that metal hammers could be avoided for any stone dressing in favour of Chalcolithic methods using stone hammers. Experiments were carried out using both these methods where it was discovered that a good hand held stone hammer was equally effective as any modern metal hammer.

Foundation. **E6**. The site chosen for the second reconstruction was in a very gently sloping area with only c0.30m difference in height between its northern and southern parts. Accordingly relatively little terracing would need to be carried out in order to create a level building foundation. The vegetation was first cleared and then a very broad, shallow scoop 5.20m in diameter was created by digging to a depth of 0.20m in the N and spreading this material out along the S part of the area. A total of 20 barrowloads of soil was removed in this exercise. Initially, the amount of small stones and pebbles and the organic material included suggested that the area which had been built up with the excavated material might prove to be an unstable foundation. However, construction went ahead with the building of the first few courses which very easily settled on the surface created which became compacted and solid after just a few months of exposure. In general, however, the area was cleared down through the loose plough soil and bark chippings to a much harder and more compact surface. The decision was taken that the wall height would be kept to a minimum, 2.0m, and that additional head height would be achieved within the building by lowering the floor in a deeper type of scoop similar to those noted in many period 4 buildings. However, in order to test the origin of this profile period 4 floors, the scoop was not excavated during the initial phases but left until the building was nearing completion. The aim of this was to see how far a scoop would be created merely by the construction process itself of mud mixing and sorting.

Stonewall. **E7**. The pattern for the wall was set out on the ground surface laid bare within the foundation cut by describing a circle in the soil using a sharp stick and a string attached to a peg hammered into the ground at the centre of the building. Stones for construction were acquired from around the site at *Lemba*, particularly from the spoil dumps and from the collapsed terrace wall to the W of the site. Eventually this supply became diminished and the vast stocks of suitable building material being discarded from the excavations at *Kissonerga* were exploited. This proved to be an almost inexhaustible source. The stones were all carefully sorted into 3 categories of building materials. Large, flattish stones which were broader than they were thick and which had one fairly flat face were selected as facing stones. These were characteristically 0.20-0.40m broad and only 0.05-0.10m thick and were generally of calcarenite, limestone or reef limestone although some igneous stones were also used. Smaller fist-sized stones and cobbles were set aside as infill for the rubble core and the smallest pebbles and chips were kept in buckets for use as snecking stones[23] and gap fillers. Each of the facing stones was carefully studied before use in order to determine its most suitable orientation within the wall and only dressed on one face if necessary. This task was initially very time consuming until enough experience had been gained a certain degree of proficiency achieved in the handling of the material. It also became apparent that the majority of the stones readily lent themselves to wall-building and it was suspected that they had all either been carefully selected or already roughly dressed in prehistory for that very purpose. Considering the sources of these stones, from Chalcolithic sites, it is not surprising that this was the case and it must be acknowledged that Chalcolithic builders themselves played a small part in the construction of this building.

The first course of the wall was laid directly onto the ground surface with the larger stones being slightly dug into the ground in order to key them in and secure them more firmly. This applied mainly to the facing stones which were set with the inner and outer faces 0.50m apart. These were then consolidated with a cobble and rubble core to form a solid footing for the rest of the wall. The facing stones for each course were laid out first along several metres length of the circuit of the wall with frequent alterations to positions being made to ensure the most suitable location for each stone. These were then carefully removed and a layer of mud mortar spread over the earlier surface before the facing stones were returned to their original position and packed with cobbles and mud. Snecking stones were used to secure any large gaps or slightly loose blocks. When this stage was completed the stones along the top of the wall were quite clearly defined and provided a good, irregular surface upon which to locate the next layer of stones.

Large amounts of mud were need for the mortar which was frequently 0.02-0.06m thick due to the rough, knobbly nature of the stones. This was quite in keeping with what has been observed in period 4 walls. The mud mix used consisted only of soil and water without the addition of any organic material which would have been redundant for this particular task. The soil was derived from old excavation spoil dumps to the NW of the site and was generally a fairly ashy, gravely soil with a low clay content.[24] The soil was very roughly sorted to remove any of the larger or sharper pebbles leaving much of the smaller pebbles and gravel within the mix. Any pebble which interfered with the setting of the facing stones was dealt with at the time and presented no great problem. A small hollow adjacent to the site was created to provide a hole for mixing the small amounts of mud which were needed for this type of construction. The rational behind this method was to conserve water by reusing the same

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[23]These are tiny fragments of stones hammered into position to secure the gaps between the larger stone elements in a wall and to hold them more firmly in position. They are generally the flakes resulting from the dressing and trimming of the larger stones although in this case ordinary pebbles were used.

[24]See sedimentation analysis of this type of soil in section 2.1.

hollow which would retain a constantly moist base and to create a place where all the materials could be effectively mixed and contained. The natural tendency was for this hollow to become a hole of 0.40-0.50m depth which became increasingly difficult to use and was finally abandoned in favour of a new hollow. Two such mixing holes were created which very quickly became filled with debris and general rubbish and are now sealed beneath **RH3**.

A door way was established in the NW arc of the wall and was initially 1.0m wide which was later reduced to 0.70m. A threshold of large flat stones was also built and set firmly into the ground surface secured with mud mortar. The wall was carried up for 12 courses to a height of 1.55m before the wooden door lintels were established and for a further 3 courses to a height of 1.80m before the main timber ridge pole and rafters were laid. The wall head was completed at 17 courses giving a total height for the wall of c2.0m which is really only evident in the SE where the ground slope is at its lowest. An average of 150-160 of the large stones were used in each course of the wall giving a total of 2550-3000 large stones. The rubble core in this wall comprised a very small volume of the total bulk of the wall but had it been wider, say c0.70m, then the rubble core would comprise a significant proportion of the wall. However, roughly 30% of the total volume of the wall was composed of the mud mortar which is a significant proportion in a wall which is supposedly stone built. This relates quite well with the observed proportions from period 4 walls and reflects the nature of this building method.

Roof. **E8**. The design for the roof was created to accommodate the archaeological information which was now available to the project and to establish a simple but effective form of roofing. The main ridge pole was a timber c5.0m long and with a diameter of c0.20m. This was to be set in the wall head at a height of 1.80m on 4 short lengths of thick branches which were to support and spread the load of the roof. It was initially thought that the task of lifting the timber to this height and setting it in the wall would require the help of 3-4 persons or some form of block and tackle. However, in the end the builder did not take full account of Hebridean strength and determination which managed to accomplish the task single-handed while I was devising more elaborate, academic solutions. A total of 32 rafters of 2.6m length and diametres of c.0.10-0.15m were then laid over this ridge pole such that one end rested on the ridge pole and the other on the wall head projecting slightly beyond the edge of the wall both to the back and to the front of the building. Smaller timbers were then set at right angles to these along the E and W edges of the roof which had not been covered by the main rafters. All timbers were debarked and trimmed before use. Course 16 of the wall was then built in order that all the timbers were securely founded within the wall itself and did not just rest on the wall head. After this stage the final course of the wall was completed on the outer edge only as a type of containment for the organic and soil components of the roof.

Bamboo was collected from various stands around *Lemba*, stripped of all its leaves and dried for a week to produce long, firm reeds. It was obvious that many of the bamboos were not best suited for roofing as the bamboo stands had fallen out of use and through neglect had grown into bent and twisted plants which were more difficult to incorporate into the roof. They were, however, laid at right angles over the rafters but the use of bent and inferior plants meant they could not be laid regularly on the roof but had to be heaped and infilled with shorter pieces to form a comprehensive cover. A layer of long straw and a layer of seaweed giving a total compressed depth of 0.05-0.06m was spread over the bamboo and then covered with a 0.05-0.06m thick layer of mud. This mud was quarried from the excavation spoil dumps and was mixed in the same manner as the mud mortar without the use of organic binders. A small smokehole was built in the centre of the roof using two curved stones set on edge facing each other and then built up in mud. Over this was laid a thick layer of dry reddish/brown soil quarried from the edge of the terrace to the N of the site. This was sculpted into a dome shape with 4 drainage channels to the N,S,E and W. The sculpting created a layer c0.20m thick at the centre which tapered off towards the edges where it was c0.10m thick. Part of the design of this building was to test different types of roof drainage and so accordingly, a ridge of mud was built around the perimeter of the roof to create a gutter with drain spouts at the ends of the drainage channels. The drain spouts themselves were made from flat stones set in mud projecting beyond the wall head. The whole roof was then covered with c0.10m thick layer of havara clay derived from the quarry pit to the N of the site. This was spread evenly over the entire roof and broken down by trampling.

Before the roof was completely covered with havara two test areas were created in order to determine the best method for finishing the roof. A patch of havara plaster mixed in the ratio of 1 water:3 havara was spread on a wetted surface and covered. A second patch was laid as dry havara and then broken down before being thoroughly soaked. The former patch dried very rapidly and cracked to such a depth that during any rainstorm the water would be carried more deeply down into the roof structure. The second patch also dried out and cracked but to much lesser degree and showed indications of the formation of water resistant surface with the clay platelets being orientated to form a thick laminated layer. The final roof finish was accordingly carried out in this fashion with the havara first being broken down to as fine a powder as possible and then soaked thoroughly on several occasions over 3 days. This created a very satisfactory finish. The gutters and drains of the roof were finished off in a clay havara plaster and thoroughly burnished with a rounded pebble burnisher. This produced a very fine plaster-like finish which showed very few signs of cracking due to the vigorous burnishing but which did not stand up at all to the rigours of a Cypriot winter. It was washed away in the first few rain storms and the drains served only to channel all the water onto 4 points of the wall where it was able to do much greater damage. A more robust material and longer drain spout would have been more effective but less authentic and so this system was abandoned. In 1993 this system was demolished and a new type of wallhead based on that of **RH3** was constructed. Three courses of stonework were laid in rings set in mud around the top of the wall with each course recessed slightly inwards from the course below. The construction involved the addition of a further 28 buckets of mud incorporating 80litres of water, and 33 buckets of stone to the wallhead. This was done in conjunction with repairs to the roof in which 36 buckets of straw were spread over the existing roof, followed by 90 buckets of soil and finally 72 buckets of havara.

On the whole, however, the design of the roof was highly successful and in keeping with available evidence. The pattern of roofing timbers and the 0.40m thick layers of soil and organics created a solid domed shape which had great resistance to rain damage, apart from the gutters which were later rectified. Many of the problems with springiness and colonisation by birds which so damaged the roof of **RH1** were overcome without compromising the experimental integrity of the structure. It was, accordingly, adopted as a pattern for future reconstructions on the site.

Wall finish. **E9**. Experiments were carried out with several types of wall rendering to determine the most suitable for this type of building. Reports from the excavations at *Kissonerga* describe a "plaster" which is applied directly to the exterior of the wall face. This is most clearly seen on the S face of **B1046** although no sample of this material has survived for analysis. Lime plaster is known from the period, for example basin 1386 in **B1046** (sample S250), but is very rarely used the preference appearing to be for a white clay, most likely to be havara. Typical of the types of wall finish from this period are the clay plasters from **B3**, 737 (sample S174 & S332), and from **B834**, (samples S207, S268, S284 & S298) which are of varying thickness, with an organic content of 10-30% and which are applied directly to the wall. Accordingly, a plaster of pure ground havara clay mixed with water to the consistency of a potters clay was applied directly to the exterior wall face which had first been thoroughly soaked. A second experimental area with straw mixed in to the render was also applied to the wall. Both were wetted and burnished regularly over several days to create a fine smooth finish. Burnishing was carried out using a wetted hand, a trowel and a flat stone with best results being achieved with the last method. Many small cracks still persisted but, on the whole it adhered well to the wall and formed a good surface. A further experimental patch was also applied to the W face of experimental wall **E4** where it can still be seen.

In the final instance, sand was added to the mixture to act as a stabiliser for the clay and to bulk out the material. This was mixed in the ratio of 1 part water: 2 parts sand: 2 parts havara with large amounts of organic material being added. By this time of year straw was in very short supply and all loose straw lying in the surrounding fields had been collected for the roof leaving only seaweed as the most readily available organic material. The clay plaster was applied quite thickly to a wetted wall surface evening out the irregularities of the stone work and producing a fine smooth surface. The render was applied in the shade in order that each section had 12 hours of drying time before being exposed to direct sunlight. It was still possible to manipulate the material the day after it was applied making it easier to cure the surface by repeated wettings to seal the cracks and burnish the render into a more stable cohesion with the wall. On the whole, the render set quite rapidly with less cracking than is apparent on the **RH1** wall face and dried to a hard white material. It was initially not taken directly down to the ground surface in the belief that this would encourage it to act as a wick and suck up any moisture from the ground surface to the detriment of the wall as a whole. This was later seen to be false with the success of the **RH3** render which was applied directly down to the ground surface without encouraging any excessive vertical water penetration. The render on **RH2** survived for several years with some minor repair work to the damage caused mainly as result of the roof drainage system but which eventually became badly eroded and was replaced in 1993 when the wallhead was also renewed. The new render was a soil render similar to the second surface on **RH1** which proved to be the easiest to produce and apply. In this case it was carried down to the ground surface and right up to the new wallhead. In 1995 the entire building was painted in red ochre purely as a decorative fancy. This survived for one season only.

Interior. **E10**. The various internal features of **RH2** have been discussed above under the experiments with plaster. Included in this is a small porch or entrance threshold which was also built at the time of the original construction of the house. This consisted of a foundation of small stones set roughly in a square with a drainage channel dug across the entrance way all of which was covered with a layer of clay plaster in a material identical to that used for the first render on the building. The drainage channel also linked up with a packing of stones with had been set into the gap between the wall and the foundation cut for the building on the N side. This is similar to rickles of stones found around many of the buildings at *Kissonerga* on the upslope side. It was hoped that this arrangement might provide suitable drainage for water running down the slope of the land during heavier rain storms. This whole system, however, rapidly became very silted up and is now no longer visible. Its presence on archaeological sites is, therefore, still a mystery.

A floor was also constructed inside the building after the completion of the hearth and plaster basins. It has long been suggested that some sort of earth floor constructions existed during the Chalcolithic periods although examination of various floor samples could produce no clear indication that they were other than well worn ground surfaces. However, it was decided that an attempt be made to create a "beaten earth floor" to see what sort of results could be achieved from the local soils. A dark red terra rosa soil obtained from the nearby coast was used in the experiment. This was well mixed with water in the ratio of 1.5:6 and allowed to mature over several days until it was thoroughly moistened and plastic but not in any way fluid. The soil was damp to the touch and remained in a cohesive lump when compressed in the hand. This material was spread to a depth of c0.02m over the floor which had been soaked, worked into the surface by trampling and then vigorously pounded with stone hammers to consolidate and level it out. The procedure was carried out over several days with the occasional moistening to make the dryer parts more manageable. It produced a fairly good surface with a degree of cracking and which took many days to dry out completely. The cracking was worst along the edges which were laid more thinly and where there was the least amount of traffic. However, when dry the cracks over the rest of the floor did tend to encourage it to break off in lumps especially when subjected to the frequent battering it received from a procession of modern footwear. How far this damage could have been averted had visitors been excluded from the building or forced to remove their shoes is unknown. Such an experiment can only realistically be carried out under more controlled conditions, but it did have a relatively promising start.

The door arrangements for the building were based on an interpretation of the door in the building model KM1446. It is apparent that a solid freely moving door set on a socketed element and supported by a bracket of sorts was commonplace in the Chalcolithic period. The door was made out of several planks of wood doweled and glued onto split logs which were themselves mortised into an upright door post. This sat in a socketed stone set into the ground just inside the doorway against the inner N door jamb and was supported at the top by bracket of 2 lengths of timber lashed together and mortared into the wall in a position directly above the socketed stone. This was a very successful arrangement and was easily constructed. The only difficulty for modern hands was the drilling of the holes for dowels which was done with a power drill rather than a prehistoric brace and bit arrangement.

Time and Materials. The construction of the building was carried out over several months from April 18 to June 15 1990 by two persons. Including the work that was done several months before on the foundation it is estimated that a total of 120 man/days was expended on the project. This includes the preparation of the site, the collection and preparation of the materials as well as the actual construction itself. The only factor which cannot be included within this estimate is the time which would have been spent selecting, cutting and transporting the timbers for the roof. This is an aspect of the project which we cannot envisage as the availability of suitable local stands of timber is unknown. We can only assume that they did exist and that it did involve a considerable amount of effort. There is also the question of the use of the Land Rover for the collection of water, bamboo, stones and straw. The need to do this on foot without the use of traction animals could add considerably to the amount of time taken. Straw and stones would have been readily available on site from recent harvests for the former and from old buildings for the latter. Bamboo is also seen to grow in profusion in close proximity to the site. The main problem would be the supply of water. If the construction work was done outside the dry season then there is a very good chance that water would have been available very close to the site along the line of the present series of wells. Certainly it would have been available in the streams to the N and S of the site one of which is, even today, perennial.

Element	Water (litres)	Soil (buckets)	Organics	Stone (large)	Stone (small)
Floor	90	54	none	none	none
Wall	4199	1187	none	2550	170 buckets
Roof	418	954	138	none	30 buckets
Render	456	204	30	none	none
Total	5163 litres	2399 buckets	168 buckets	2550	200 buckets

*Table 10:. Amounts of materials used in the construction of **RH2**. One bucket contains 8 litres of soil or 8.5 kg of stone.. These estimates do not include the internal features or internal wall plaster which was carried out as a separate exercise.*

The estimates of materials for the construction are impressive. Considering that this was a stonewall building the amount of soil and water needed are surprising and actually surpasses the amounts needed for **RH3** which was entirely mudwall. The amounts are best summarised in tabular form.

Roundhouse 3 (fig.103-112).

The success of the first two reconstructions paved the way for a third based on different archaeological information available from the earlier structures excavated in Area 1 at *Lemba*. It was carried out during September and October of 1990 by a team of four people from Edinburgh

University.[25] The team worked to a very carefully prepared plan devised on the basis of previous experience and with strict instructions about the recording and monitoring of the exercise. Their progress was followed with interest, not just for the sake of the outcome of the reconstruction, but also to see how easily it is to convey the experience of others to a novice team.

Background. The intriguing, but generally poorly preserved, remains from Area 1 at *Lemba* have provided a limited insight to the earlier structures of the Chalcolithic period. By comparison with the remains of some of the period 3b buildings they were extremely crude and encouraged a rather biased view of the earlier periods. Several interesting anomalies were also presented by the structures with regards to the types of flooring, the foundation and the wall construction. All the buildings appear to have been founded in shallow hollows with the wall sitting directly on the edge of the hollow. No stone constructed base course has ever been detected although stones did figure in the wall construction frequently only on the inner wall face. There are also descriptions from the excavators of "green" clay surfaces extending across the floor and running beneath the walls themselves. These features are most clearly seen in **B5** which is one of the best preserved structures in the area. Unfortunately, the timing of the excavations at Area 1 preceded the current project by several years and the rigours of many Cypriot winters have so denuded the site as to make any sampling of the various features and structures impossible. The types of materials used can, therefore, only be surmised but it is unlikely that anything substantially different from other buildings at *Lemba*, *Kissonerga* and *Mylouthkia* was in use.

The building was to be constructed as a 4.0m diameter structure built with the doorway facing SE and sitting in a broad foundation hollow onto which a clay floor of bentonitic clay was to be laid. The walls were to be 0.40m thick and constructed entirely in mud with no stone foundation and standing c2.0m high. A roof similar to that of **RH2** was envisaged but the smaller size of the building meant that the rafters could span the entire width without being divided at the ridge pole. As a demonstration of roofing supports, a forked timber upright was to be inserted beneath the ridge pole resting on a flat stone on the floor of the building. A slightly different wallhead treatment was also suggested based on traditional Cypriot houses in which stones were placed along the edge to give support to the roof soil and help prevent erosion. The site chosen for the reconstruction was a fairly level piece of ground immediately to the W of **RH2** lying over the pits and hollows created during its construction where the mud was mixed and stored. As with **RH2** no modern tools were to be used during the actual construction of the building apart from containers to transport materials.

Foundation and Floor. **E11**. The building was first laid out using a string and stick to define a circle with a 2.0m radius. This area was then hollowed out to a depth of 0.30m at the centre and the spoil removed. The earlier pits were encountered and did provide some concern for the builders as to the stability of this area as a foundation but this has, so far, not proved to be a problem. The clay floor

[25] The team was comprised of Elspeth Alexander, Patrick Begg, Derek Alexander and Kevin Craw who were all undergraduates in the Department of Archaeology at the time. Their enthusiasm for the task and their interest in reconstruction in general is gratefully acknowledged. The design and specifications for the building were laid down by myself. This is the only reconstruction in which I was not able to participate in the actual construction work.

was then constructed directly over the freshly dug hollow. The bentonitic clay was obtained from a small area on the terrace edge overlooking the canyon cut by the Agrokalami R to the N of the site. Initially, the material was prepared by breaking up the dry clay lumps and mixing it with soil in a ratio of 3:1 before adding water. This, however, was not allowed to mature for long enough with the result that the mixture was lumpy and too liquid to be of much use as a floor surface. It was subsequently pulverised more finely and smaller amounts of water were added. This was then spread on the floor to be trampled and soaked over several days to attempt to create a suitable surface. In the end it proved to be a futile task as it did not survive the construction of the rest of the building. It is also unlikely that such a surface could be adequately laid and cured in such dry exposed conditions. The floors which are thought to have existed at *Lemba* may require some other type of explanation as they certainly could not have been constructed in this fashion.

<u>Mudwall</u>. **E12**. A mud mixture similar to that perfected in **RH1** was advocated for the construction of the wall of the new building. The soil was obtained from the old spoil heap to the S of the site and was initially only roughly sorted. After several injuries sustained during the treading of the mud barefoot, however, it was passed first through a sieve to remove the larger and sharper elements. Two mixing areas were established and the mud was prepared in batches of 15-17 barrowloads of soil: 190 litres of water: 1 sackful of straw. This was sufficient to complete one whole course of the wall. This was then left to mature for 1-2 days before being applied by hand to the wall. Each course was laid and shaped by hand being kept level by reference to the horizon over the sea and being kept vertical by eye. Both proved to be satisfactory methods of construction and control. About 15-20 stones were placed in the upper surface of each course to help key in the subsequent course and 2 layers of stones were also pressed into the base of the wall along its inner face. By the end of the project a batch of 17 barrowloads could be collected and mixed in 3 hours and laid in a further 2-2.5 hours with 3 people working together. This was the maximum pace at which work could progress and was constrained mainly by the time required to allow each course to dry out sufficiently to ensure that the worst of the cracking had ceased. As the season progressed it took longer for the courses to dry out, commonly 2 days, and it was noticed that the cracking of the wall was considerably reduced as a result. A total of 323 wheelbarrow loads, 1940 buckets, of mud was used in the construction of the wall incorporating 3610 litres of water and 19 sackfulls of straw. About 450 small stones and cobbles were also built into the wall.

When the plan of the building came to be drawn it was noticed that the wall width varied from 0.40-0.49m and that the shape of the wall on plan was anything but circular. This had a satisfying similarity to excavated building plans.

The door lintels were added at a height of 1.60m as were the two stone built ventilation holes. The lintels were set into the mud and snecked with small pebbles to plug the unavoidable gaps between the timbers. The two vents were small stone constructed apertures set diagonally opposite each other in such a position as to lie beyond the proposed siting of the ridge pole. The easiest and strongest design for the vents involved the placing of flat stones in a box formation which was held in place by the mud of the wall. The ridge pole was also set onto the wallhead at this height resting on short lengths of timber and the forked timber upright established. This was done after the ridgepole had been set and involved manoeuvring the forked timber into position before securing the dished stone beneath it by hammering it and slightly digging it in. The subsequent weight of the roof compressed down onto the ridge pole and was translated down into the upright holding it firmly in position.

Roof. **E13.** The roof construction was very similar to that of the previous roundhouse with 14 timber rafters c4.0-4.30m in length and diametres of c.0.10-0.15m laid across the wallhead and ridge pole projecting to the back and front of the building. All timbers were debarked and trimmed before use. Over these, and at right angles to them, were laid over 100 stalks of bamboo collected from stands around the village which had been cut to lengths of 0.50-3.0m and spread to provide a fairly flat surface. This formed a support for a thick layer of seaweed which prevented the 0.05-0.10m thick layer of mud overlying it from oozing through the bamboo. A thick layer of reddish/brown soil was heaped on top of the mud and sculpted into a slight dome shape before the final layer of havara was added. The havara was firmly trodden in to break up the clods and soaked on several occasions to create a waterproof seal. Eventually this process was abandoned to allow nature, in the form of a series of downpours, to complete the task. A small triangular smokehole was built in stone over the central position of the building projecting up beyond the final layer of havara. The entire thickness of the soil part of the roof was c0.35-0.40m at the centre.

The wallhead itself was built up in a series of 3 rows of stones the first one resting on the top of the mudwall and the subsequent ones resting on the lower course but set slightly in from it. These were held in place with mud mortar and the final havara layer was carried slightly over the edge of the topmost stones. This produced a solid and very durable wallhead which has lasted relatively undamaged since it was built and has been used as a model for **RH4-5** and for the alteration to **RH2**.

Wall Render. **E14.** The exterior wall render for the building was similar to that devised for RH1 and was made up of reddish/brown soil quarried from the terrace edge to the N of the site. The soil was sieved to remove all the coarser gravels and stored in a pit 2.0 x 1.5 x 0.40m situated to the W of the large roundhouse. This was mixed with 250 litres of water, 3 large sacks of straw and 1.5 sacks of seaweed. The mud was very thoroughly trodden and turned and then left to mature for 40 days during which time it was regularly soaked and turned to prevent it from drying out. Within 7-10 days the mud had turned from a reddish/brown colour to an olive green with an evil smell to match. After the end of the maturation period the render was plastered on to the wetted wall surface both by hand and with the use of a metal trowel. An hour after application the render had begun to dry and crack slightly and so was further treated with a dilute slurry of the same material which was worked well into the surface sealing the cracks and bonding the material more firmly to the wall. A fine havara powder was thrown onto the surface at this stage to help with the drying out and to provide a further clay component to the finished surface. It was then repeatedly burnished with a smooth pebble to give a smooth leathery surface of a light buff brown colour. This render survived quite well but was patched up the following year using material which had fallen off the wall. The problem envisaged with rising damp being carried up the wall behind the render did not materialise although dampness along the base in wet weather is a feature of all the buildings. The main difficulty appears to be with the growth of plants at the base of the wall which use the render as a shelter and send shoots up between the wall and the render causing it to dislodged and fall away. This and the effects of the weather resulted in the entire render surface being renewed in 1992-3 along with that on the other buildings. This was in the natural course of expected events.

Interior. The floor of this reconstruction has been described above under the foundation construction. It still survives in the building but has been damaged during the construction process and has now been considerably masked by material eroded in through the doorway. The door itself was constructed in much the same way as that for **RH2** with the exception that the upper bracket has been pegged together rather than being lashed. The only other feature present in the building is the series of test plaster areas **E15** which have now largely been demolished.

Time and Materials. The construction work was carried out from September 5 to November 20 1990 by a total of 4 persons although, at any one time only 3 were involved in the building work. This involved a total of 180 man/days of work or 2 full months for 3 people. The laying of the first course of mud, however, did not take place until the beginning of October due to the unforeseen length of time taken on creating the floor and fulfilling other tasks. By that time most of the materials had also been assembled and prepared. A more realistic estimate for the time taken for such a building excluding the floor would, therefore, be 105 man/days or 5 full weeks for 3 people. Considerations about the use of modern methods of transport, collecting and the availability of materials are the same as those for previous constructions.

The amounts of materials incorporated into the building were carefully recorded although it should be noted that more material appears to have been collected than used. This is due to various experimentations with different types of clay flooring and to the creation of a mud mixing pit in which mud was allowed to mature over 5 months in order to see how well the material survived and whether or not it produced a better quality of mud. It did indeed produce a good quality material but the organic content had decayed completely and had to be reconstituted with more water and straw before use. Some of the other materials collected, particularly the straw was used in other experiments the following year. The rest of the materials used in the actual construction are presented in tabular form.

Element	Water (litres)	Soil (buckets)	Organics	Stones (small)	Bamboo
Floor	152	78	none	none	none
Wall	3800	2040	75	300-400	none
Roof	430	330	84	c300	100 stalks
Render	519	108	54	none	none
Total	4901	2556	150 buckets	300-1000	100 stalks

*Table 11: Amounts of materials used in **RH3**. The organic material comprised 84 buckets of seaweed and 47 of straw.*

Roundhouse 4 (fig. 113-118).

The need to provide some form of on-site storage area and the enthusiasm of volunteers[26] with the experimental work being carried out at *Lemba* promoted the construction of a fourth building on the site. It was decided that this should follow on from the established programme of reconstructions and test the next stages of the experimental work. The two elements which were to be examined were: to investigate the possibility of building in mudwall using a much dryer type of mixture which would be pounded in to position and; to study the archaeological effects created by one building being constructed onto the side of another. The site chosen for this new building was the NE side of **RH2** onto which a relatively small, 3.0m diameter, building was to be tacked. The general form of the building was to be the **RH3** early type with mudwalls set directly onto the ground on the edge of a shallow hollow. The doorway was to face SE as with the area 1 buildings which would effectively orientate the building away from the main area of visitor attraction and ensure it would better serve its additional function as a store room.

Foundation. **E32**. The foundation hollow for the structure was created on an area of ground hard up against the NE side of **RH2** and was dug to a depth of c0.35m as a regular, straight-sided flat-bottomed pit 3.0m broad. Although this is not reflected in any archaeological evidence, it was felt that a dished surface would be impractical as a storage area and so a compromise was made with this one aspect of the reconstruction. This of course created difficulties with the entrance arrangements which would entail a steep step down into the building.

Mudwall. **E33**. The wall was built in mud set directly onto the ground surface inside the area of the foundation hollow and hard up against the sides. The initial course was laid quite deeply being 0.35m wide and 0.22m high in order to accommodate the deep foundation. Subsequent courses were c0.10-0.12m high and were mixed from 72 buckets of soil, 18 buckets of straw and 160 litres of water. It commonly took 2 persons 2 hours to quarry and sieve the soil and 3 persons 2 hours to mix the mud. The material was mixed and allowed to mature for 1-3 days in a mixing hollow which kept it moist. It was then laid on the wall by hand in a drier state than had been the case with the previous roundhouses and pounded into shape using a stone hammer. This proved quite an effective method of construction and was used for most of the building apart from the first few courses. No modern tools were used to shape the wall or to keep it true and vertical resulting in a generally well constructed wall but one with a pleasing, natural sinuous appearance. This was quite acceptable in a circular building where the basic cylindrical shape provided an internal strength and stability which would not be the case in rectilinear straight walled structures. A total of 16 courses were laid bringing the building roughly up to the same height as **RH2**. A doorway was constructed facing SE with mud doorjambs and an earth threshold with a slight lip on the outer perimeter to exclude water runoff. The door lintels and a small window directly

[26]The majority of the work was carried out in August to September 1993 by Kenneth Aitchison of Edinburgh University who was assisted by Alistair Rees in the time he could spare from work on the lime plaster experiments in **RH1** and **RH2**. Their skills and help with the project are greatly appreciated. Some help was also afforded by volunteers from a season of excavation at *Kissonerga*. The design and specifications for the building were laid down by myself and I was fortunate enough to be present for about half of the actual work on my way to and from a conference in Jerusalem.

opposite the doorway were set into the 14th course and the roof beams were built into the succeeding course.

Roof. **E34**. Ten roof beams (dia. c. 0.10-0.15m) were laid across the building from front to back without the support of a ridge pole which was unnecessary in such a small structure. The timbers were partly obtained from a vine trellis belonging to the local *mukhtar* ,with his permission, as some of the project timbers being stored on site had begun to rot. All timbers were debarked and trimmed before use. At right angles to the rafters a mat of bamboo stalks was laid and over this a layer of palm fronds giving it, temporarily, a very Biblical appearance. These and the next layer of seaweed were contained around the perimeter by the last course of mud on the wallhead, course 16. The soil component of the roof consisted of, firstly, a layer of mud followed by a thick layer of reddish/brown soil and finally by a layer of white soil/havara. The edges of the roof were constructed in three layer of small stones set one layer slightly in from the lower layer and mortared together in mud. This roof construction was built to tie in exactly with that of **RH2** to form a superficially continuous structure. This created a roof which was c0.40-0.50m thick at the centre where a small stone-built smokehole had been constructed.

Render. **E35**. The exterior wall surface of the building was rendered in a reddish/brown soil plaster which had been mixed with straw and seaweed and allowed to mature over several days. This was also applied, surprisingly easily, to the under surface of the roof where it could act as protection against various insect infestations as well as fire.

Roundhouse 5 (fig. 119-120).

The most recent building to be constructed on the site has been conceived with a very specific purpose in mind and that is to study the effects of erosion, collapse and burial on various types of artefacts and archaeological deposits. This experiment and reconstruction have been built with the sole purpose of being destroyed and becoming part of the archaeological record. No maintenance will be carried out on the building and no members of the public will be allowed access to the area.

The site chosen for this experiment, **E36**, is immediately adjacent to the experimental mud and pisé walls **E4** and **E20** which are also incorporated into the construction. As well as studying the effects and processes of abandonment, erosion and collapse on the contents of a building the experiment also sought to investigate the effects of burial on various types of earth wall construction, particularly mudwall and pisé.

A very small building **RH5** was constructed in mudwall, **E37**, between the experimental walls and **RH2**. The building was 2.6m in diameter with a wall thickness of 0.25m. It was constructed rapidly without being laid out and without the ground being prepared in advance in order to observe the effects of rapid *ad hoc* construction. Each lift of the wall was constructed out of mud mixed from 6 barrowloads of soil sieved through a 2.0mm sieve, 3 buckets of seaweed and 60 litres of water. It was constructed for 18 courses and stands just over 1.90m high. No stones were used in the construction and the walls were all built by hand. This was roofed in almost exactly the same manner as **RH4, E38,** although some of the more dodgy timbers were used in order to accelerate the process of collapse. In fact, this strategy was so successful that an internal timber support had to be inserted to prevent the almost immediate collapse of the roof before even the artefacts had been included. The house was not built to the same height as the other structures on site as this was not necessary. The doorway faced SE although no door was actually added. Two stretches of mudwall extended from the building to the earlier stretches of experimental mudwall and pisé creating a miniature courtyard. This was filled with various pieces of site rubbish, mainly organic material, and c20-30 barrowloads of soil simulating the accumulation of deeper deposits from the collapse of a theoretical adjacent structure and the subsequent abandonment of the area.

At the time of writing this project was still in the process of being created. The artefacts have still to be inserted into the house and other test experiments involved with the survival rates of postholes and fencing have still to be included.

4.4 Recording and Monitoring.

The most important aspect of any experimental work in archaeology is the immediate recording and the long term monitoring of the experiments (fig. 121-125). From this the process of data recovery, analysis, the establishing of hypothesis and the development of further experimental work can evolve. This is a very long term process which, ideally, should continue beyond the research life of any one individual. The LEV has now been established for eight years and is only just beginning to enter the second stage in which data recovery and analysis form the most significant aspects of work on the site. All work on the experimental projects has been carefully recorded both during and immediately after completion of the initial stages of activity. This has included a comprehensive photographic record of the buildings and experiments as they were being carried out and as they changed over the years. In addition, records of the materials used, their source and amounts were also recorded as an indication of the quantities being brought onto site. Activities were all defined and recorded in relation to the building under construction and also plotted on a master plan of the site giving a clear indication of the sorts of deposits which might be expected to occur in any one area. People working on site were encouraged to behave in the most appropriate manner for the task in hand, in other words, to dump materials, dig pits or carry out tasks without concern about disturbing previous activities. This was all part of the study of the formation of archaeological sites and was only tempered by the injunction that modern materials should never be brought on to the site. The main exceptions to this directive occur in **RH1** where, sealant, wire mesh and some cement appear in repair work. The creation of this data base of activity on the LEV site will be a valuable tool in the long term study of site formation processes. The record of changes effected upon the buildings are a good indication of the sort of long term management of these buildings and of what sort of impact this may have had on the developing archaeological site. Some of the alterations and repairs to the various structures have already been mentioned but it is worth recalling them to understand the developments which can affect these types of buildings. Only the first three buildings have stood long enough to need repairs and to indicate patterns of change.

The Buildings.

Roundhouse 1. This building very quickly developed problems with its roof where damaging leaks appeared after almost every major rainstorm within a year or two of construction. The springiness of the myrtle underlay prevented the compaction of the soil component and allowed the penetration of water through the thinner areas. Some severe gullying was seen to develop over some sections of the wall head on the interior of the building which, if unchecked, would seriously undermine and damage the roof structure at those points. The projecting eaves also provided an ideal nesting site for large colonies of birds which burrowed into the roof further encouraging its instability and weakening the eaves. Severe erosion and gullying along the edge of the eaves illustrated another design problem which was rectified when they were rebuilt in stone which hindered the movement of sediments off the roof. The addition of several more tons of soil onto the roof at regular intervals gradually built up a thick enough layer that compaction was sufficient to flatten and bury the myrtle branches completely. Wire netting along the underside of the eaves helped exclude the bird colonies but begs the question of prehistoric solutions to this problem. The increased weight of the additional soil on the roof, however, did result in the development of much more serious problem when one of the horizontal ring beam timbers split at the point where it had been notched to receive the adjacent timber over the NW upright. This was immediately propped up with another timber to prevent further cracking and it could be seen that a continuation of this process through time would lead to a proliferation of posts within the building in an apparently random pattern.

The type of foundation for this building was a terraced scoop which was cut into the NE part of the site most deeply and terraced out towards the SW. The NE foundation cut very quickly became colonised by a varied plant community which thrived on the protection afforded by the eaves and the retention of moisture in the trench. This encouraged the accumulation of silts and rubbish which over 2-3 years has gradually caused the trench to be infilled providing an even more appropriate garden environment for the plants. The retention of moisture by this growth and accumulation has led to problem of rising damp which can be seen on the interior of the building as a white line c0.50m above the floor. This could lead to severe damage being done to the wall over time and has caused cracking and destruction of parts of the plaster mural constructed on that part of the wall. The downslope side of the foundation on the SW saw the build up of a very distinct talus slope c0.30-0.40m high and c0.50m wide with the formation of a drip trench seen as a continuous pitted arc along the talus slope. This did not appear along the N side of the building or at the entrance.

The exterior of the building was rendered as it was being built in a high quality render of reddish/brown soil. This survived many years but did gradually weather particularly on the W and SW sides which were exposed to the most severe storms and prevailing winds. The eaves did provide a very effective cover to the top of the wall where very little damage was done even on the most exposed sides. However, after several years the render had reached the stage where it was providing very little protection in places and was accordingly replaced. The old material was removed and reincorporated into the new render which was made in much the same way as the original but was not allowed to mature for so many days. This produced quite an efficient render which is still on the building. In 1993 experiments with painting the exterior of the building using red ochre proved successful creating a very dramatic impression on the visitor. This was subsequently extended in 1994 over the W half of the building and a sealant was also included in the paint.

The interior of the building has undergone several changes particularly on the back wall which has seen 3 different surface coverings being applied; a mud render, a clay plaster, and latterly, a lime plaster. This is also painted with red ochre and a sealant. The lime plaster floor and hearth with two radial ridges have been described above and are still very much central features to the building. Some minor damage has occurred to the ridge nearest the door where continuous traffic has broken the surface. This was repaired with a modern plaster.

Roundhouse 2. As with the first roundhouse the main difficulty presented with **RH2** was in the roof construction which used a clay plaster to build the gutters and drains. This was not a success and caused severe erosion at the four points along the wall where the drain spouts projected. The gutters and spouts were completely removed in 1993 in favour of 3 rows of recessed stones set in a mud mortar. More organic material and havara was also spread over the roof at this point to increase its height to accommodate the renovated roof edge. This has proved to be very successful and is still in place. The gentle dome shape of the roof has allowed water to run off freely but has inhibited the development of strongly laminated surface layers which are taking longer to form than on the flatter roof of the larger roundhouse.

The initial render on the building was a clay, gravel and straw mix which was plastered very thickly over the walls. Erosion at the wallhead particularly under the drain spouts had removed all the plaster and cut into the mud mortar around the stones threatening to loosen them. A thick conical, deposit of eroded silts was seen to develop at the base of the wall below these drain spouts. This damage was repaired on several occasions using a mud and straw mix until the new wallhead and roof edge were built at which point the entire building was rendered in a reddish/brown soil mud. In this case the render was taken right down to the base of the wall and still survives today. A considerable talus slope has now developed all around the building and is most noticeable to the N where there is little scope for it to erode away. The foundation cut and pebble infill are now well buried and completely obscured from view. Along the S and E the ground slopes away from the structure so the talus has developed as a very broad gentle formation. The effect of this is to accentuate the difference in height of the building between the N and S sides and to facilitate access to the roof from the N. The small porch which was built in clay plaster over the threshold has been very badly eroded and is now so covered with silts as to be almost indistinguishable from the general ground surface.

The interior of the building has undergone several renovations as detailed above. In 1991, a year after the construction of the building the interior features and floor had begun to show signs of erosion and damage from too much traffic. One of the plaster basins had been smashed and c0.70m^2 of the floor had been destroyed. Sweepings from the floor were collected and sorted to determine the origin of the material. A total of 15 litres was collected, the majority of which was composed of broken and pulverised fragments of the beaten earth floor itself. Other material included fragments of plaster basin, roofing straw, general eroded silts and miscellaneous material like cigarette ends, pebbles etc. Most of this deposit within the building appeared to composed of the results of vandalism and straw falling from the roof as it settled. The following year in 1993 this exercise was carried out again at a time when there was no obvious vandalism and after the roof had ceased shedding so much into the building. On this occasion 36 litres was collected and sorted. About 20% of the material was flooring which occurred as smallish fragments or as a fine silt. A full 75% of the material was of a different colour from the flooring and appeared to match the type of soil used to make the mud mortar for the walls. Only a small fraction, <1%, was organic material and the rest was composed of small pebbles etc. including a fairly large flint flake which was not part of the original construction process. After this exercise the interior of the building was renewed in lime plaster as it was felt the pressure of visitor numbers would only continue the process of damage at an accelerated rate.

Roundhouse 3. By the time this building was constructed the various elements of mudwall, roof details, and render had been the subject of various experiments which had established the most effective methods for their construction. The main difficulty with this building was in effect its position on the site and the orientation of the doorway which allowed sheet erosion across the site to enter the building flooding it for days at a time. The channelling of water by the first two roundhouses into a path between the three buildings was threatening to cause severe damage to this particular building. The floor had been almost totally removed on the SW side and covered with a deep layer of silts almost burying the socketed stone supporting the main post. Rising damp along the NE wall arc was seen as a band of white salts c0.30-0.50m above the wall base. Penetration of the ground water in behind the wall render had loosened it and encouraged the growth of vegetation using the render as a protective cover and further weakening it. In April 1992 c15-20% of the render had eroded off the wall and it was decided that the building needed to be re-rendered. All the loose material was removed leaving only 20% of the original render. This comprised 4 barrowloads of render which were removed from the building and reconstituted with a further 20 barrowloads and then applied to the wall. The pathway between the three buildings was hollowed out at this stage to channel any water runoff away from the roundhouse into the area to the W. This proved to be quite effective and created the impression of a slightly sunken pathway across the site.

The Excavations.

A total of 5 small test excavations have now been carried out on the site of the LEV reconstructions and associated experiments. These were in the nature of examining material as it formed on the site and of investigating elements which would not survive longer due to proposed experimental activity in the area. The first test pit was dug at the base of the wall of **RH1** on the W face where a talus slope and drip trench had formed. It was apparent that continued use of this area to bring in materials with the Land Rover was disrupting the natural formation of the archaeological deposits which should be excavated before too much damage occurred. A second trench was cut outside the S side of **RH3** where a proposed path/channel would remove important information about the deposits surrounding the construction of that particular building. The third[27] and fourth[28] trenches were cut against the N ends of the experimental mudwall and pisé walls, **E4** and **E20**, before their incorporation into the burial experiment **E36**. The pit used for the first lime plaster making experiment **E19** was also half sectioned[29] before it was used for subsequent plaster making.

<u>Trench 1</u>.

This was a narrow trench 1.30m long and 0.50m wide against the SW wall of **RH1** where the talus build up and drip trench formation was particularly well preserved (fig 121, 125). Apart from the building debris resulting from the construction of the building this area was also used in 1989 and 1990 for the storage of large dumps of havara and gravel both of which should be reflected in any excavation. Layers are numbered from top to bottom.

1.1. The ground surface in this area was well compacted into finely sorted havara silts with a good, structured clay-like surface containing some embedded pebbles and gravels. There is evidence of the runoff of havara from the roof being carried down the wall onto the ground where it spreads out to form these clay surfaces. The top 2.0cm consists of alternating laminated layers at the base of the talus with slightly coarser more poorly sorted havara and small pebbles gravels further up the slope and closer to the wall. The material is a compact white/buff silt with a lot of havara present in the form of clasts and lenses. These have the appearance of discontinuous laminated clay plaster surfaces 4-5 layers deep in places. There is also buried plant growth from the previous season incorporated into the layers near the wall face giving the appearance of a series of badly preserved fine clay plaster surfaces with straw impressions in the fabric of the clay. There is also a 1.0cm thick layer of havara lying up against the wall which has been worked into the stones of the wall plinth but which lacks any exterior face. It looks very much like what has been interpreted as a badly preserved plaster face to the wall. However, as there never was a finish to the wall plinth this low down it can only be the result of havara erosion from the roof. The drip trench is clearly identifiable as a 6.0cm wide band of silts with small stakehole-like features along its length. It has compacted more deeply into the lower layers. This whole deposit forms a very clean and distinct cleavage plane with the underlying layers.
1.2. A patch of poorly sorted, compact brown mud containing many organics lies directly up against the wall face. It has a compacted surface with many havara patches in evidence and small stones projecting. The angle of slope between this layer and the underlying material is quite steep and would

[27] See description under discussion above on mudwall.
[28] See description under discussion above on pisé.
[29] See description under discussion above on lime plaster.

have resulted in increased erosion which may explain its limited extent. The material is very similar to that used in the construction of the building.
1.3. Extending away from the talus slope and not very well preserved under the greatest build-up of material is a series of layers of grey silts on the more level ground. The upper surface is smooth and polished and contains havara patches. It starts c0.80m away from the base of the wall and is only 0.5-1.0cm thick.
1.4. From the base of the wall and extending beyond the end of the trench is a thick layer of poorly sorted, compacted mud containing silts and fine gravels. There are a lot of compressed straw stalks lying over the surface of the mud which has the appearance of being the type of material used in the construction of the wall itself.
1.5. Underlying the entire deposit is a layer of brown, crumbly soil with a very granular structure and which breaks down to fine silts and grits. The layer is not very well compacted and has a very irregular broken surface with large sherds and stones lying in it at random angles. This is covered with what appears to be a layer of burning. The layer is c2.0cm thick and rests over a very hard compact surface.

It is interesting to see just how well all the known activities in this area are reflected in such a small test trench. The lowest layer is, of course, the levelling and terracing carried out before the construction took place and is typical of broken up soil spread over the surface vegetation. Its survival in the same state with very little alteration to its original structure when deposited is significant and should be detectable on an archaeological site. Layer 1.4 and 1.2 must represent the construction of the mudwall and the rendering respectively with layer 1.3 resulting from the winter rains which occurred during the construction of the building. Only layer 1.1 and the drip trench form the types of deposits which excavations at Souskiou indicate are to be associated with building erosion. Nearly the entire height of the stone plinth has been buried, therefore, in deposits which result only from the construction process. This could have quite important considerations for archaeological sites where such poorly sorted materials would be given little consideration and would merge well with any actual *in situ* mudwall construction. The drip trench is also a significant and identifiable feature.

Trench 2.

A second trench 1.30 x 0.50m was cut to the SE of **RH3** from the wall base to the centre point of the pathway (fig. 125). This was the area where the timbers for **RH2** were debarked and where the mud for the mortar was mixed. The edge of one of the mixing holes may even project beyond the foundation of the wall into the area of the trench. Material from the construction and erosion of **RH3** would also be present. The layers are numbered from top to bottom.

2.1. This layer is confined to within 0.50m of the base of the wall and consists of very well compacted laminated lenses of brown silts with some grits and a lot of organics as straw chaff. It has the appearance of a series of floor surfaces formed on the top of each laminated lens. The compaction and the water sorting of the surface of each lens, however, indicates that they have been weathered and compacted to form the surface.
2.2. A layer of white havara chunks and gravels which are well compacted and are overlain in places by patches of fine laminated grey silts and a lot of organic material (seaweed). This dips below the base of the wall.
2.3. Extending across the trench but truncated by the foundation cut for **RH3** is a layer of brown silts with a lot of organics in the form of straw, seaweed and woodchips. It contains sherds and pebbles

dispersed in a random fashion and much black ash, burnt soil and a fine grey ash intermixed to a depth of 10.0cm.

2.4. The lowest layer is a friable brown soil with irregular pebbles and gravels and a lot of unburnt organics mainly in the form of roots and some wood chips. The upper surface is compacted and weathered.

The preparation and construction of the two buildings is evident in this small sounding. The lowest layer may be part of the spread of material laid down for the formation of a terrace for **RH2** while the layer above that, 2.3, contains many of the materials which were used during the construction. The floor of **RH3** is seen in layer 2.2 while 2.1 represents the erosion of material of the wall of the building. It is surprising that nothing survives to indicate the mudwall construction of the house although this may reflect the care of its builders.

Conclusions and Future Programmes.

Experimental reconstruction has allowed the structural testing and validation of interpretations of particular Chalcolithic building types. It has been possible to determine the sizes and number of postholes needed for roof supports as well as their spacing for different roof styles. It is obvious from **RH1** that greater thought and more evidence is needed to understand the types of roofing on the large period 3b buildings. Considerations about the thickness/regularity of walls and the amounts and types of materials included in them are important for understanding the extent and nature of deposits which would result from them. We should not expect vast amounts of soil to be deposited from such buildings, particularly on a site where constant use and erosion are consistent factors of dispersal. Conversely, the many small stones used even in mudwall construction would be a significant addition to a site. The failure of dished surfaces to develop during construction indicates that foundation hollows must have been deliberately constructed elements of Chalcolithic buildings and should be considered as an important diagnostic feature. It was apparent from **RH2** that compaction of floor surfaces was really only a consideration near the centre and in areas of greatest traffic leaving much of the rest of the floor in an unconsolidated state which could have a bearing on its identification in an archaeological context. The foundation cut outside the walls of the period 3-4 buildings was duplicated in reconstruction but was very rapidly infilled with silts and building debris leaving the gully of stones which is so often found there on excavation as an enigma which should be interpreted as other than a drainage feature. The lack of evidence from excavations of a drip trench around the buildings has also been highlighted suggesting that the roof form developed for **RH1** needs further modification and that the types of roof used on **RH2-5** are probably more accurate. Experiments with different methods of construction have produced building materials which can be used as a comparative reference collection. It has also been possible to examine limitations imposed by prehistoric levels of technical ability. It was frequently necessary in reconstruction to restrict the abilities of some of the builders suggesting that the quality and scale of prehistoric buildings was probably determined more by cultural constraints than by technical limitations. Questions of longevity, cycles of repair, patterns of erosion and resistance/susceptibility to damage are also being considered. Initial repairs were quite limited but, as time and the elements progress, it is interesting to see how repairs even as minor as the rendering of the structure can have a significant impact on the development of deposits around the building. The difficulty with flooding in **RH3** and the quantities of material in **RH2** fallen or eroded from the roof and walls give some indication of the ways in which non-cultural material can accumulate inside buildings during their occupation and should be reflected in the archaeological record.

Obviously such a long term and established project will require a considerable commitment and research design covering many years to come. Much of the data which can be generated by the project will not become apparent until further work has been carried out with respect to site formation and the decay of buildings. This is the longer term aim of the project. The more immediate aims have already been achieved with an understanding of the materials and building processes adding an important contribution to an understanding of some archaeological deposits. This will completed with initiation of several more experimental projects including the series of postholes experiments and the completion of the burial experiment at **RH5**.

The posthole experiment has as its aim the investigation of survival rates in a Mediterranean environment and the various forms into which these postholes will develop under different conditions. This programme has already produced results with the excavation of the postholes associated with the pisé experiment and the use of posts in **RH1**, **RH3** and **RH5**. In these cases both earthbound and stone-set posts are being monitored in an interior environment. Exterior posts are being established with the skull post to the SW of **RH2** and the proposed use of posts and stake fencing in the burial experiment **E36**. Reynolds has demonstrated with his work at *Butser* that many of our preconceptions about postholes must be discarded in favour of more rigorous observation and a more flexible approach to their interpretation (Harding *et al*, 1993). It is now important that these sorts of long term studies be carried out in the Middle East.

The possibility of a few more reconstructions at *LEV* to answer specific questions should also be considered and will probably be carried out over the next few years. The work carried out so far at the *LEV* has established the methods and materials of construction and has contributed greatly to our understanding of these buildings. However, the buildings which now stand are plagued with problems of site presentation and visitor access which, particularly in the case of **RH1**, has considerably reduced their experimental value. A series of buildings should now be constructed for purely experimental purposes based on a strict observation of the various building types which have now emerged from the present study. Access to these must now be restricted to those with a research interest in them under strict guidelines. The possibility of carrying out reconstructions of building types not yet attempted is also an important consideration and it may even be necessary to look towards earlier periods to complete an understanding of the background to these buildings. The construction of a *Sotira* type house as well as a period 2 *Mylouthkia* house and a period 3 rectilinear house should be considered. There are important aspects of all of these buildings which need to be investigated within a comprehensive project. The amount of information which is now emerging from the remarkable *Mylouthkia* house make it a very tempting proposition.

Linked to the programme of reconstruction but tackling a very different aspect is the need to investigate different forms of building destruction. The burial experiment is one aspect of this project. A more dramatic aspect will be the burning experiment. Mud buildings can in fact be notoriously difficult to destroy as part of a rapid and deliberate policy. The report by Col. Gordon from the front line of the British Empire in its attempts to quell the rebellious Pathans describes the extraordinary measures employed to demolish simple mud brick, earth roofed houses (Gordon, 1953). Mounds of brushwood, boxes of dynamite and homeless families featured in their endeavours to secure the boundaries of Empire. In addition to the difficulty there may be in the burning of a mud house there is the question of naturally occurring domestic deposits which may be interpreted as destruction of the building (Coles 1973, 64). Experiments designed to investigate the difference between destruction and other forms of collapse should be initiated.

Further work must also be carried with lime plaster making using different source materials in order to determine if kafkalla and limestone are equally suitable and if their production involves similar resource allocations. The work already carried out has demonstrated the need for greater rigour in any interpretation of the impact of the industry on society and on the environment. However, a series of carefully monitored kiln firings would record the variation in amounts of material and product involved in this industry and would add authority to any claims made from these experiments.

Storage has always been an important consideration in the interpretation and understanding of prehistoric society. Our knowledge of storage facilities and the ability of society to plan for the future can colour our views of the past. Reynolds work with storage pits at *Butser* has demonstrated how a simple experiment can explain the mechanisms and effectiveness of storage strategies within a society (Reynolds 1979, 71ff). In the Chalcolithic periods several such strategies can be identified. Large store vessels do exist from the later periods (periods 3-4) but the earlier Chalcolithic (period 2) has a different tradition which may be reflected in the large bell-shaped pits discovered in the lowest levels at *Kissonerga.* An experiment with storage in one of these pits could help to confirm their original function. Both food storage and water collection/storage could be considered.

The next stage in the development of the project is the collection, study and characterisation of the various materials used on the site for construction in a systematic and regular fashion. To an extent, this has already been initiated, but it must now be carried forward and include samples of all the various elements and buildings constructed on the site. It is only by creating such a broad data base linked in to known source materials and methods of production that a comprehensive system of classifying and identifying archaeological materials can be developed. A continued programme of excavation and monitoring of the structures will also add to this data base.

With such a large project it is possible for one person to consider in any depth only one particular aspect of the potential programmes which could be initiated at the *LEV* centre. Some of the research involved with buildings and site formation processes have been outlined with this project; the possibilities for artefact research and crop production have not really been developed and only remotely considered. Their potential is enormous and the inclusion of these aspects within the overall aims and development of the *LEV* is one of the most important aspects for the future of the project as a whole.

Chapter 5: The Architecture[1] of the Erimi Culture.

There is no other trace of them.
They owned their valley lightly,
with easy hands.
They walked softly here.
So will the others,
the ones I seek.

<u>*Always Coming Home*</u>.
Ursula le Guin 1985, 5.

5.1 The Architectural Background.

Mud technology came early to the Middle East. By the time great roundhouses were being built at *Kissonerga* and *Lemba* the use of mud as a building material was already a very old and well known technique. The areas around Cyprus, the Levant to the E and Anatolia to the N had evolved elaborate and highly sophisticated building traditions by the fourth millennium BC as, indeed, had Cyprus itself. It is perhaps worth considering this background and placing the traditions we see in Cyprus within a much firmer context. To do this we must look back four thousand years before the first Chalcolithic houses were constructed.

There are several characteristic elements which occur throughout the building traditions of Chalcolithic Cyprus. There are also some structural features which are specific to the EChal and which are significant when considering the antecedents of Chalcolithic buildings. These are:

1. Circular, single-roomed, free-standing buildings.
2. Mudwall construction which later developed into stonewall.
3. Construction within a hollow.
4. Flat earth roofs.
5. The use of mud plasters and, later, lime plasters.
6. The segmentation of space within the building by low piers, ridges and defined floor areas.
7. Platform hearths.
8. Bell-shaped storage pits and underground pit/tunnel complexes.

Although these do not cover all elements of building in Cyprus they do highlight the most characteristic features of the EChal which can be used for an assessment of underlying traditions and origins. In the following discussion, a word of caution should be sounded about the terminology used by the various publications. "pisé" and "plaster", as has been mentioned earlier, are both used rather too freely and without much understanding of the terms or their implications. At times "pisé" is being

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[1] The word architecture is used here advisedly. There is the view that architecture cannot exist in a society which neither has architects nor builds to a common code of design and standards. This is clearly a narrow ethno-centric view which can easily be demolished. By definition, if architecture is the art or science of building and art is a practical skill or its application then architecture is the application of the skills of building. These skills and the buildings which result from their application have been thoroughly covered in previous chapters. Whether or not architects working to a common code of practice existed in prehistory is unknown, but the evidence can certainly be used to argue such a case.

used variously to describe massive mud construction or mud block construction rather than using "mud brick" which has very particular dating implications within the Middle East. In order to avoid perpetuating this sort of sloppy usage, specific building terms will only be used where there is good evidence for doing so. In most cases the term "mudwall" seems more appropriate than the use of "pisé" and, similarly, efforts will be made to distinguish mud from lime or gypsum plaster where the evidence supports such a distinction.

The chronology of the prehistoric periods of the Middle East is still undergoing rapid change with highly divergent views being expressed and challenging many long held perceptions. The fundamental changes wrought by the radio carbon revolution in archaeological dating methods and the increase in the quality and number of excavations are responsible for this development. Many of the authors mentioned below subscribe to quite divergent chronological schemes which makes a correlation of the evidence difficult. The very meagre indications of contact between Cyprus and the adjacent mainland further complicate the process of placing Cypriot material culture within a broader Middle Eastern framework. Links based upon the presence of obsidian on Cypriot prehistoric sites or upon ceramic similarities with the Asiatic Khirbet Kerak pottery complex or upon a few sherds from Tarsus are still too tenuous to be entirely creditable.[2] However, it is not the purpose here to become embroiled in that particular minefield which can only be resolved through a consensus debate. The intention is rather to indicate broad traditions which have existed across the Middle East and to highlight particular developments or cultural complexes which may be of relevance to a study of the type of architecture encountered in Cyprus. Traditions favouring circular buildings and mudwall construction will be accorded particular attention as will the development of the lime plaster industry. Accordingly, only broad chronological divisions will be used. The three main areas of interest will be the Levant and Syria, Anatolia and Northern Iraq and, of course, Cyprus itself (fig. 2). The following is a general review of building materials and traditions in the Middle East. Only those sites which have produced good evidence or more available for discussion have been included. The absence of excavated major sites from the following discussion does not indicate a failure to take account of their importance but is rather a reflection of the small size of the exposure of the earliest levels on some of the massive later prehistoric and early historic sites. Many sites, therefore, will be excluded but in the context of a general review and discussion, this is to be expected.

The Levant and Syria.

Some of the earliest settled sites of the Middle East can be found in the Levant area. During the ninth and eighth millennia BC the Natufian Culture flourished and has been identified and excavated at the sites of *Al Khiam*, *Eynan* and the earliest levels at *Beidha* and *Jericho*. The small soundings at ***Beidha*** uncovered remains of brick shapes and a tradition of building in clay or mudwall

[2] This is discussed in greater depth by Peltenburg (1981) who summarises the available evidence and points the reader toward further discussions.

in the earliest levels (Kirkbride 1968, 264ff). ***Jericho*** produced a mud platform structure with a massive boulder stone wall which has been interpreted as a sanctuary (Kenyon 1981, vol III, 268). The succeeding proto-Neolithic period is very poorly understood and has produced almost no architectural remains. Trench 1 at *Jericho* produced 2 postholes, clay balls and lumps of hard gritty material which represented the meagre remains of the structures.

Towards the end of the eighth millennium, with the emergence of the first of the Neolithic periods, the Pre-Pottery Neolithic A-B, the evidence is more complex and indicative of a developed, sedentary society. This is referred to by Moore (1981) as Neolithic 1-2 while Aurenche (1981) assigns it to his periods 2-4 with the PPNB being further subdivided into two. A very useful analysis of the architecture of the PPNB has been conducted at the site of *'Ain Ghazal* in Jordan (Banning & Byrd 1987) where rectilinear stonewall houses set into foundation hollows and with massive lime plaster floors have been identified. ***Jericho***, where the PPNA-B was first identified, produced a remarkable series of structures including the massive stone built town wall tower which was thickly covered in a mud plaster. The PPNA buildings were largely circular and built in stone or in hog-backed mud bricks set on a stone foundation (Kenyon 1981, vol III, 18-61). These were frequently semi-subterranean with foundations of a continuous trough of cobbles constructed beneath the wall and extending out across the floor to form the base for a floor of clay (*ibid*, 52). Steps made out of brick were frequently built leading down into the buildings (*ibid*, 47). Clearly, however, mudwall was still an important constructional element. Walls were also constructed in a "red pise and stone" with sockets for timber uprights and a line of softer earth inside the wall. Plaster was made from huwwar (havara) and was applied to walls and floors (*ibid*, 22, 28). There are also indications of wattle and daub constructions (*ibid*, 51) and roofing of a framework of reeds and branches covered in mud (*ibid*, 48). Timber, which had been cut and squared, was also used quite extensively for roofing, door frames and as constructional uprights (*ibid* 30, 52). By the PPNB period plano-convex or hog-back mud bricks were the predominate building material which also heralded the arrival of the first rectilinear buildings. Mudwall was still used and, indeed, survived into the EBA levels where it was faced with mud brick (*supra* 73-4, 100). Massive stone foundations and thumb-impressed bricks laid as stretchers sometimes three course thick and thick white plaster, burnished floors characterised the buildings of this period (*supra* 73ff).

The houses of aceramic ***Beidha*** (levels IV-VI) were small, cicular, drystone structures. Levels I-III were also semi-subterranean although they were rectilinear and built in immensely thick stone walls with floors of a thick white lime (?) plaster which was carried up the walls (Kirkbride 1969). ***Ramad I*** produced a succession of half buried huts made of (?)mudwall covered in thick layers of a white plaster and furnished with ovens and shallow basins (de Contenson 1971). Mellart (1975, 58) describes the plaster as being lime but this may only be on the basis of its white colour. Wattle and daub huts of reed and clay with mud brick pavements were uncovered at ***Aswad*** and ***Ghoraife*** near Damascus (de Contenson 1981). At ***Munhatta III*** a large circular building 20.0m in diameter with a central pebble paved area and rooms arranged around it was located. Small fragments of reddish baked clay with imprints, some intentionally modelled, was interpreted as being wall and roof material (Perrot 1964,). Rectilinear houses with fine plaster floors and loaf-shaped brick constructed walls were also uncovered. Further north, on the Euphrates, ***Bouqras I*** was the site of two superimposed villages of rectilinear (?)mudwall houses with floors of "beaten earth" covered with a coating of plaster and crossweave matting (Akkermans *et al* 1983). ***Mureybit***, also on the Euphrates, produced good evidence of early mud architecture. Level I contained thin clay walls (10.0cm thick) which still bore the impressions of timber uprights. In levels II-VIII round or curved buildings made of red clay walls with roofs of timber and reeds and pavements of large limestone blocks characterised the settlement (van Loon 1966). ***Abu Hureyra*** comprised multi-roomed mudbrick buildings by Neolithic 2 with high quality lime plaster floors (Moore 1981).

There is a hiatus in the record between the aceramic and the ceramic Neolithic periods in the Levant which is particularly marked at *Jericho* and *Beidha*. This is not as marked further N along the Euphrates where there seems to be greater evidence of continuity. The ceramic Neolithic, the Pottery Neolithic A-B (PNA-B) is also referred to by Moore as Neolithic 3-4 and by Aurenche as his periods 7-8 with periods 5-6, the early Neolithic, reflecting the gap which appears further S. At ***Jericho*** Kenyon still records pit dwellings with (?)mudwall constructed on a clay and rubble base (1981, 137) although walls made in bun-shaped bricks are also found. In trench II.xi the small area opened up to reveal this period produced good remains which Kenyon records could have been more informative had more time been available to excavate them carefully (*supra*, 137). She confirmed the existence of walls made of "terre pise" with angular stones set around the edge. Elsewhere in the area, at ***Ramad II-III***, ***Bouqras II-III***, ***Munhatta I-II***, ***Byblos***, and ***Ras Shamra IIIc*** (*supra*) large, complex villages and towns of rectilinear, multi-roomed houses in bun-shaped mud bricks on stone foundations were being built.

This appears to establish the pattern of Middle Eastern village layout for the entire region until the very end of the late Neolithic with the emergence of the Yarmukian, Munhatta and Wadi Rabah Cultures represented at ***Munhatta 2B1-2*** and *Ghrubba* towards the middle of the fourth millennium BC. At *Munhatta 2B2* circular, semi-subterranean huts 3.0-4.0m in diameter with a paved area and central hearth were being built. The site was also characterised by the construction of bell-shaped storage pits. By *Munhatta 2B1* circular dwellings 3.0m across were founded in the centre of large, shallow scoops 10.0-12.0m in diameter which were filled with basins and silos. The hut was constructed in bun-shaped bricks set on a stone foundation and are very similar to the *Jericho* PNA huts and may, indeed, be partly contemporary (Mellaart 1975, 239). There are strong links between these late Neolithic cultures and the Chalcolthic Ghassulian period[3] which is characterised by the type sites of *Teleilat-Ghassul*, *Beersheva-Abu Matar*, *Beersheva-Safadi* and *Shiqmim*. These are thought to have reached a floruit c3500 BC and are characterised by rectilinear mudbrick architecture in the later phases. However, the earliest phases at ***Teleilat-Ghassul*** produced circular mudwall houses set into

[3]For a discussion of these links see Moore (1973) and Elliott (1978) both of whom support the view favouring a development from late Neolithic cultures in Palestine.

sunken hollows with posts to support the roof and well-laid pebble floors (Hennessy 1982, 56). The two ***Bersheeva*** sites revealed, again in their earliest phases, remarkable settlements of subterranean dwellings in deep pits which have been lined with stone and mud walls and which give access to underground tunnel and chamber complexes and bell-shaped storage pits (Perrot 1984). Nearby ***Shiqmim***, although largely rectilinear mud brick in nature, also had circular mortuary structures with stone foundations and mud brick upper structures with flat earth roofs (Levy 1987).

Anatolia and Northern Iraq.

The architectural traditions of Anatolia since the earliest settlement in the area appears to have emerged, fully developed, in the form of rectilinear, mud brick housing in compact farming villages. The aceramic Neolithic of the eighth and seventh millennia BC is typified by such structures. ***Haçilar I-VI*** was a village of small rectilinear houses of mud brick laid as alternate headers and stretchers in a mud mortar and set on stone foundations. Internal posts suggest a flat earth roof construction and wattle and daub walls were used for internal partitions and kitchen areas outside the main door. Mud plaster was used extensively on the walls and floors although some floors of lime plaster were constructed over a bed of cobbles (Mellaart 1970). ***Suberde*** appears to have been constructed in a similar fashion although the walls were constructed in alternate courses of different coloured mud which does not appear to be brick (Bordaz 1965-66). At ***Çayõnü Tepesi I-V*** stone was used for most wall construction until level IV when mud brick makes an appearance. An excellent survey of the development and change of constructional and architectural features of this remarkabel site has been produced by Schirmer (1990). Three phases of different building activity was defined on the site; the grill plan phase, the broad pavement plan phase and, the cell plan phase. A magnificent terrazzo floor in phase III was constructed in pink and white pebbles set into a concrete foundation before being ground smooth. A ceramic house model from the cell plan phase as well as roofing fragments give a good idea of how the houses might have looked with their flat, parapetted roofs slightly overhanging the wallhead (Braidwood *et al*, 1969-71).

The remarkable site of ***Çatalhõyük*** fills the gap between the aceramic Neolithic and the ceramic Neolithic in the region and is one of the most extensively excavated prehistoric sites in Anatolia. The houses are built in mud brick with no stone foundations and are rectilinear in plan, packed close together using shared walls with no interconnecting doors. It seems most likely that the roofs were of solid, flat, earth construction and carried general village traffic to provide access to the houses. Internal roof supports in the form of timber uprights, low mud platforms, mud bins and square mud platform hearths were features in most of the houses. Access to subsidiary rooms was gained through very low doorways. Mud plaster reinforced with gypsum and sometimes lime was also applied to the walls and floors where it was decorated with layers of intricate representational murals (Mellaart 1967). ***Can Hasan III*** also consisted of house complexes built in mud brick although "mud slabs" are also described. Internal buttresses and platforms were also a feature of these houses. Mud plaster and, occasionally (?)lime plaster, was used on the walls (French 1968).

In E Anatolia and N Iraq there appears to have been a strong tradition of mudwall (tauf) building during the seventh and sixth millennia BC before mudbrick became the normal building material. Aceramic ***Jarmo*** produced multi-roomed rectilinear houses in mudwall construction set on stone foundations and with floors of clean, packed mud laid over beds of reeds (Braidwood *et al* 1983). ***Shimshara 9-16*** also appears to be built in the same tradition although rectangular mud slabs visible in section may indicate brick or mud block construction (Singh 1974). ***Samarra I-VIII*** has multi-roomed houses with walls of varying thickness made of lumps of mud of irregular sizes plugged with smaller lumps and smoothed over with a mud plaster (Singh 1974). At ***Umm Dabaghiyah*** the earliest houses are of mudwall set on stone foundations and with the front wall covered in gypsum plaster and sometimes painted red. In levels 11-12 the houses were small, irregular, curved single-roomed buildings which had become rectilinear multi-roomed constructions by the upper levels (Kirkbride 1972). The early levels at ***Yarim Tepe I*** produced buildings in clay block covered in gypsum plaster with both circular and rectilinear structures side by side (Merpert *et al* 1969). This tradition of mudwall or mud block construction on a circular plan and the use of gypsum plaster continued into the Halaf Period where it is characteristic on ***Tall Arpachiyah*** (Mallowan *et al* 1935) and ***Yarim Tepe II*** (Singh 1974).

By the end of the fifth and the start of the fourth millennia BC Anatolia, like much of the rest of the Middle East, had emerged into a period of change and development which was to lead to urban civilisation by c3000 BC. Building traditions were elaborate and diverse reflecting very fluid changes in society. Yakar (1985) identifies five settlement types in the region as being; small open villages or farmsteads, large villages some defended, tightly nucleated settlements, towns and, temporary settlements of pastoral groups. Rectilinear mud brick multi-roomed houses with mud or lime plaster seem to typify most of these settlement groups.

Cyprus.

The two Neolithic periods preceding the Chalcolithic period in Cyprus are well illustrated by excavations at six main sites. There is a hiatus of up to 1500 years in the archaeological record between the aceramic Neolithic Khirokitia Culture of the 7th and early 6th millennia BC and the ceramic Neolithic Sotira Culture of the 5th millennium BC[4]. The chronological hiatus between the Late Neolithic Sotira Culture and the Chalcolithic Erimi Culture (3500-2300 BC) has proved to be more apparent than real, although there remains a difficulty in explaining the sharp cultural differences that exist between the two periods in other respects.[5] Whether or not these gaps are a result of inadequacies

[4]This lacuna is based upon the available C^{14} dates and the lack of continuity in the material culture. For a more complete treatment of the subject the reader is referred to its discussion by Todd (1987, Ch VIII, 173ff).

[5]Unlike the earlier lacuna, the Sotira/Erimi transition is based solely on the spread of the radio carbon dates from a few excavated sites. The very obvious evidence for the continuity of the material cultures, however, suggests that this gap is not as

in our data recovery is still under question, particularly for the Sotira/Erimi transition for which there is strong evidence of some continuity in the repertoire of the material culture. However, they do at least reflect a major dislocation between the periods which should be considered when evaluating architectural traditions in the area.

The type site of the aceramic period, ***Khirokitia***, has been excavated on several episodes; the first by Dikaios before 1950 (Dikaios 1953) and more recently by le Brun (1984, 1989). A settlement of densely packed circular buildings surrounded by several phases of a town wall was found. The buildings were small, less than 4.0m,[6] and were largely built in stone although mud brick was also extensively used. Three types of wall were identified;

1. Stone built with a mud mortar.
2. Baked brick. One example only which is a single brick thick.
3. Stone and mud brick or "pisé"
    a. Exterior double thickness stone layer with an interior layer one brick thick.
    b. Double thickness of stone surrounding a layer of brick or "pisé" and, on the interior, a layer of brick, two of stone and a final mixed layer.

There are evidently a number of different functions and, possibly, traditions involved in this rather complex system of wall construction. The method of roofing with an inner wall acting as the main roof support may be indicated but the possibility that some of the walls, particularly of the last type, represent repair or rebuilding should not be ruled out. The use of the term "pisé" in this context is also suspect as it would be almost impossible to construct in this method with these types of walls. The bricks were of variable colour and consistency and were whitish or reddish/brown. They were hand-made rather than moulded and contained decayed vegetal matter. On analysis they were found to be largely composed of calcium (40-60%) with other trace elements (le Brun 1984, 31). The walls and floors were plastered and there were a few pieces of mud indicating the use of reeds 1.5cm in diameter and spaced at 10.0cm intervals. Building S.85 was unique in the state of preservation of the burnt roof which was discovered collapsed on the floor of the structure. On careful restoration its structure was determined and is described as a set of timber rafters resting on the wallheads of the building upon which was spread, at right angles, sticks and two layers of vegetation. Two layers of mud followed by a layer of compacted earth overlay this structure and the whole roof was bound along the edges with a continuous organic band. A minimum thickness of 12.0cm is indicated for the soil part of the roof. The timber rafters rested on the inner wall layer and the roof did not project beyond the wallhead to form eaves (*ibid* 1989, 110). Other features characteristic of the buildings of this period are the internal piers which commonly occur as double free-standing elements within the buildings although they can also appear as projections from the walls associated with floor divisions. In several instances two low radial floor divisions are seen to connect with a low, rectilinear element in the centre of the building (hearth) and extend E and S to the wall (*ibid* 1989, 95, 126). Doorways, niches in the walls and passages

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significant as to imply a complete cultural break or dislocation. The arguments surrounding this transition are dealt with more thoroughly by Peltenburg (1981, 1982a), Stanley Price (1977) and Watkins (1972, 1973).

[6] All dimateres given are external measurements.

between buildings are all common aspects of the architecture of the site. The built-up nature of the archaeological remains and the progress of the excavation, which has not yet reached sterile layers, makes an assessment of the types of foundations difficult. Most houses, however, were founded on the walls of earlier buildings which is a characterisitic of the tradition of building at *Khirokitia*.

Also excavated by le Brun (1981), the site of ***Cap Andreas Kastros***, on the eastern tip of the Karpass Peninsula, has produced a similar type of settlement of the aceramic Neolithic period. The buildings are small (2.60-3.0m), circular structures with irregular enclosed (and roofed ?) areas attached to them, some as a concentric outer wall similar to tholos 1A at *Khirokitia*. The walls are mainly built of various sized rounded river/coastal stones set in mud mortar one course thick and heavily rendered with a thick (1.0-2.0cm) mud plaster. Mud bricks were also used although they are less common than on other aceramic Neolithic sites. The bricks are hand-made 30.0x15.0x8.50cm and are set one brick thick on a course of foundation stones. The upper part of each brick in the uppermost course had been pierced as if to receive some sort of upright member. They are composed of a rounded calcareous gravel, sometimes silicified, set in a pulverised white paste with no great cohesion. As with the *Khirokitia* brick it is largely calcium carbonate (65%) with clay (illite, montmorillonite, kaolinite 18.09%), silt (5.24%), fine sand (4.08%) and coarse sand (7.43%) (1981, 81). The casts of a straw binder were also present in large numbers.

Within several miles to the W of *Khirokitia* stands the site of ***Kalavassos Tenta*** where Todd has uncovered the remains of a small village of the aceramic Neolithic (Todd 1987). All the buildings are circular but there is a great size difference similar to that at *Khirokitia* leading Todd to suggest different functions with some being ancillary or storage structures within a larger compound. The walls are all of stone or mud brick and there is generally evidence for modification to the buildings. Local limestone, diabase and banded cherts are carefully chosen, but not shaped, set in a fairly thick mud mortar. They are laid with fairly flat faces giving the wall a neat and well constructed appearance. In Structure 34 large stones set together in a havara-like plaster around the inner wall base suggest the support for a wooden floor. In this structure the wall plaster stopped at the top of the stones indicating some other material below it. The four types of wall are: 1 stone, 2 mud brick set one brick thick, 3 mud brick on a stone foundation and, 4 double wall of stone and brick which can be either an inner or an outer face. However, only Structure 36 appears to have been built originally with a double wall of different materials, in this case a stone outer footing with an inner mud brick facing, the rest of such walls on site are more likely to be the result of repairs and modifications. The mud bricks vary in size (35.0x24.0x7.0cm) and colour (grey-reddish/brown-light brown) and are set in a mud mortar 7.0cm thick. In Structure 17 there is a considerable amount of vegetable matter while those to the E of Structure 14 are rather purer in texture. Some floors are plastered over a layer of stones with plaster which varies from a thick cream coloured layer to a rather fugitive and thinner white layer. Todd suggests that lime plaster was used but there is no analysis to support this and the cream colour of the thick floor is not indicative of lime plaster which tends to be much whiter. Double internal free-standing piers and piers projecting from the wall are common to many buildings, even the smaller structures. A fragment of a mural[7] depicting figures with upraised hands and painted in red onto the plaster of one of these piers is the earliest piece of structural art in Cyprus. The unusual concentric wall arrangement with projecting piers which is seen at *Khirokitia* and *Cap Andreas Kastros* is also to be observed at *Tenta* in Structure complex 14. The roofing of these buildings is not as clear as the evidence from *Khirokitia* although Todd leaves open the options of either domed tholoi constructions or flat earth roofing.

Of the three excavated and fairly complete sites from the ceramic Neolithic two have been published and provide a wealth of information about the period. ***Sotira*** near the S coast of the island was extensively excavated by Dikaios in the 1950s and became the type site which he published in 1961. Dikaios identified six house types which he classified solely on the basis of ground plan ranging from almost circular through oval and rectangular to square with rounded corners, horseshoe shaped and irregular. The most common type was rectangular with rounded corners. All buildings were stone built, at least for he lowest courses, with only House 24 being constructed with a mud foundation and a superstructure of posts resting in holes in the mud base. However, the published drawings and photograph are not entirely convincing. Other walls were constructed in coarse limestone blocks (25.0-40.0x25.0cm) set as inner and outer facing stones 40.0-50.0cm apart with a rubble core of smaller stones. A mud mortar was used and generally only 1-2 courses survive although up to 10 courses are known. These courses are never laid in regular horizontal courses. Evidence for mud brick is limited and is confined to descriptions of lumps of mud containing finely chopped straw. Dikaios himself says that no well preserved bricks were found although these lumps of mud, some mixed with quantities of ash and some with yellowish-white soil streaked with grey, were quite common throughout the site. In the absence of any description of reed or timber impressions preserved on these mud lumps it is more reasonable to assume that they were the remains of mudwall upper structures to the buildings rather than mud brick. Dikaios also postulated a conical wattle and daub roof for the circular building type although no evidence for this proposition is presented. He also sees a development in roofing from a simple flat earth roof carried on pole rafters spanning the shorter dimension of the building to more elaborate constructions with a central ridge beam supported on the wall head and internally by upright timber posts with shorter rafters resting at right angles to this on the wallhead and on the ridge beam. There does appear to be more convincing evidence for this in the form of post supports and post holes within the buildings. A total of 17 doorways were found 11 of which faced SW, S or SE. The floors were generally lower than the exterior surfaces suggesting either rapid build up of deposits or the founding of the buildings in shallow hollows. Thresholds of slabs, mud, pebbles and, in two cases, steps were also common. Floors were carefully made of a yellowish-white soil or mud which was sometimes of a high quality and well smoothed but generally uneven. Five types of hearth were described, three of which are areas of burning or shallow pits and two of which are low mud platforms with a fire pit either in or beside the platform. In nine cases flat limestone slabs are located in close proximity to the hearth, most of them embedded in it. Low mud and stone platforms, benches or piers

[7] There is now also an example of wall painting at *Khirokitia*. (A. Le Brun pers. comm.)

are also found beside the hearth, along the wall or projecting at right angles to the wall. Divisions within the building using these piers or low arcs of stones define specific areas on the floor space.

Ayios Epiktitos Vrysi on the N coast of the island is a village within the same general traditions as seen at *Sotira* and may reflect regional variation within the period. The settlement is located on a heavily eroded headland with deep gullies and ditches which have been used by the inhabitants to found their buildings in a slightly protected setting (Peltenburg 1982a). The buildings were of a similar shape to those at *Sotira* but the confined space of the headland dictates a greater irregularity. The state of preservation of organic material in the form of silicates on this site is unusual in the Middle East and gives a good indication of the original extent of organics in construction and in daily life. The nature of the site has meant that rapid build up of deposits has necessitated the repeated reconstruction of houses on the foundations of earlier buildings creating a continuous series of superimposed buildings. It appears that as levels within the site rose buildings were partially demolished and new structures created on these foundations. The result is that the lowest stone built parts of the buildings survive well at the expense of the upper parts of the walls. Only those stone foundations are now preserved as deep columns of stone wall. These walls were of calcarenite and limestone with some shaped stones al of which are laid in roughly horizontal layers set in a mud mortar. They are generally poorly constructed but there are parts where smaller limestone blocks are used and where the courses are more regular. The excavator suggests that "pise" (mudwall) was used for the upper parts of the walls although this proposition appears to be based on the amounts of earth debris inside the buildings than on surviving examples of such a wall type. Chaff-tempered bricky nodules are also present but there is only one possible example of a mud brick from the floor of H1.3. although even in this case the surfaces of the "brick" are not preserved making its interpretation as a piece of roofing or other feature equally plausible. In many instances walls are seen to be buttressed or supported by the addition of angled stone piers (H2A, H3), by the addition of a further layer to the wall (H4A), by stone props set against the wall (H6 where a large basin was used) or, by timber posts and cross beams forming a frame (H2, H3.4).

In a number of instances there is some indication of the type of roofing. In H1-132 there were silicates of compressed reeds lying on the floor and fanning out from a general focus in the SE of the building. The dark traces of what has been interpreted as timber beams also lay on the same axis and were capped by 10.0cm of clean clay which was itself overlain by 40.0cm of "pise". Angled posts preserved for 2.0m were preserved within this material. This has been interpreted as the remains of a roof preserved beneath the collapsed upper part of the wall of a building which had suffered catastrophic destruction. In H7 a series of 14 timber posts parallel to each other and 0.15-0.60m apart, the longest being preserved for 2.0m, lined up to 3 postholes in the floor of the building and were linked by a layer of fine homogenous silicates of leaves/straw/seaweed. H9 also had a 10.0cm thick layer of chaff-tempered mud and grit, a thin lens of clean sand and two layers of short lengths of (?) reed silicates and grey ash with charcoal on the floor of the building. This has also been interpreted as roof collapse. Timber posts set upright inside the buildings are also common and were, most probably, part of the roof support system. Clearly, there is good evidence for earth roofs supported on beds of reeds and a timber framework to provide the main structural support. Whether this can also be used to reconstruct conical thatched roofs, as is suggested for H7, is problematic and may be pushing the evidence beyond reason.

Floors were generally of a yellow clay and frequently were covered in silicates of grasses and broad leaves. In several instances the spiral patterns of woven reed mats were detected. Crushed limestone was also used as a floor make up and pebble paving set in mud were uncovered over parts of some floors. Entrances were commonly 0.80m wide and set in the stone wall with vertical jambs, some two stones wide and sometimes bonded into the wall. Jambs and thresholds were also framed in flat timbers as indicated by dark soil replacements. Pivot stones or postholes occur just inside the doorway and, occasionally, stone steps lead down into the interior. A blocked aperture 0.26x0.35m in size and 1.20m above the floor of H2A has been interpreted as a window. Hearths were located off-centre to the building and were circular platforms c1.0m in diameter with, at the middle, a small hemispherical firepit. They were constructed as platforms of crushed limestone, soil and grit covered with a thin layer of clay standing 0.10-0.15m above the floor. Some had grooves radiating from the firebowl, some with radial piers and some with smaller holes at the edges of the platforms.

The Chalcolithic Perspective.

Clearly, many of the traditions and building methods which determined the form of Chalcolithic houses can be found within Cyprus itself. But it does not tell the complete picture. If we look at the main features which characterise buildings at the start of the period, there are some very clear observations which can be made. Peltenburg has argued very strongly for a continuity in traditions between various aspects of the late Neolithic and early Chalcolithic cultures of Cyprus (1982b).[8] Pottery styles, in particular, show marked continuity in a strong burnished technique which is so characteristic of the EChal at *Mylouthkia*, the presence of combed ware, the broad open red-on-white painted decoration of both *Vrysi* and *Lemba*, and the classic Neolithic spouted bowl type which was uncovered at *Maa* (Thomas 1988). A degree of continuity in figurative art has also been argued by Peltenburg (1982b) and similarities in the ground stone industry are also quite striking (Elliott 1983, 33). The presence of EChal material in the latest levels of *Vrysi* and, more spectacularly, at *Philia Drakos* where underground tunnel complexes similar to those of *Ayious* were recovered, and, now the discovery of Neolithic material in the lowest levels at *Kissonerga* argue for a degree of continuity in the occupation of these sites. Indeed, Peltenburg points out that there may even be some overlap between the two cultures if purely radio carbon dates are used (1981b). From this sort of background, then, it is not surprising that building traditions as well can be traced back into the preceding period.

The single most characteristic feature of EChal buildings is that they are circular, free-standing, single-roomed structures. This was clearly not the case on the Sotira group of sites. The

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[8] Watkins (1972 and 1973) presents a different perspective on this discussion.

unusual nature of the setting at *Vrysi* may argue for special consideration in that it was not possible to build in this manner, but at *Sotira* itself and at *Philia* where there was ample space available, rectilinear and irregular buildings were the most common architectural forms. Going even further back to the Khirokitia group, the small size of the buildings and the close spacing on site is not characteristic of the Chalcolithic although the buildings were at least circular. In Cyprus, the strongly circular and free-standing aspect of the buildings appears to arrive with the earliest settlement at *Mylouthkia*. However, the appearance in period 3 at *Kissonerga* of rectilinear architecture should be noted and is perhaps indicative of underlying traditions which continue throughout the periods but are not always seen in the limited areas opened in excavation. The form of wall construction in mudwall or mudwall on a stone base does have echoes in the earlier period particularly at *Sotira* and *Philia*. However, the rough rubble and mud construction of **B200** at *Mylouthkia* has similarities with the poorly built and heavily plastered walls of *Khirokitia* and *Cap Andreas*. The very distinctive and deliberate hollows into which even the earliest Chalcolithic buildings are set has no immediately obvious antecedents in the Neolithic period. At both *Vrysi* and *Sotira* there are buildings with steps down into the house although at the former site this is seen to be in response to rapidly accumulating deposits forming in a restricted area. At *Sotira* it is less clear with most of the sections showing a fairly level and flat foundation surface. The significance of the hollow as a constructional element should not be overlooked as it is a characteristic feature of all Chalcolithic houses with great efforts being made at times to achieve the effect. The very deep cut for **B3** at *Kissonerga*, the founding of **B200** at *Mylouthkia* inside an even larger hollow and the very steep internal floor surfaces of **B834** and **B1045** at *Kissonerga* or **B5** at *Lemba* indicate its importance. The type of flat earth roof which has been determined for the Chalcolithic buildings of the Lemba group has antecedents throughout the Middle East as the most common form of roofing. However, on ethnographic evidence, a flat roof on a circular structure is arguably less common, if not unusual. The evidence from *Khirokitia*, the interpretation of the building model KM1446 and the analysis of materials from excavated buildings suggests that it was the practice in the prehistory of Cyprus. The segmentation of space within a circular building can be achieved in a number of ways. It has been carried out in the Chalcolithic period by the use of low ridges, piers and defined hollows in the floor. All these features can also be seen at the sites of *Sotira* and *Vrysi*. The radial mud and stone ridges of the period 3 buildings at *Kissonerga*, in particular, are quite distinct and have surprising similarities to ones from *Sotira*, *Vrysi* and even *Khirokitia*. Equally distinctive is the low arced mud ridge in **B152** at *Mylouthkia* which surrounds two socketed stones and terminates in pot settings. This is has clear similarities with settings at *Vrysi* which it evidently imitates. The small mud and stone piers which project at right angles to the wall, low stone benches and certain types of stone settings also have counterparts from both periods. Platform hearths, constructed in mud and with a central firebowl can be almost identical in form between the two periods.

However, despite all these very strong and convincing similarities there are still certain features which cannot be found within the Neolithic of Cyprus. From the previous discussion of the building traditions of the Levant, Anatolia and the upper Euphrates area it is clear that there several very distinct established traditions throughout the region. Aurenche (1981) describes distinct architectural zones within the Middle East based on the use of lime or gypsum plaster, the use of moulded or hand-made mud bricks, and on the type of multi-celled rectilinear buildings that were produced. His distinction between the Levant, where lime plaster and hand-made bricks were used, and the Anatolia/S Zagros region where gypsum and moulded bricks prevailed is quite telling. There are, however, even greater distinctions between the areas. Mudwall as a building technique was known from the Zagros although, even in the earliest periods, it appears to have been associated mainly with rectilinear architecure. Mudwall also appears to have been a building technique particular to the S Levant, surviving in subsidiary structures until quite late despite being replaced generally by mud brick by the PPNA. Circular, semi-subterranean architecture was a surprising feature of the prehistory of the Levant appearing again and again in different forms from the Natufian period right up to the late Neolithic/early Chalcolithic. The area harboured an enduring set of traditions which found echoes in many of the buildings of Cyprus throughout its prehistory. The final periods in the Levant before the development of full urban civilisation saw the emergence around c3500BC of the Ghassulian/Beersheva Culture group. In its earliest phases the construction of circular semi-subterranean dwellings was a noted feature. The sites at *Beersheva* also produced a set of underground tunnels and chambers with houses sunk into larger pits or hollows and storage in bell-shaped pits. The comparison with the underground complex at *Ayious* and *Philia* could hardly be more striking. The construction of circular buildings in hollows and the use of bell-shaped pits now finds similarities with the site of *Kissonerga* where such pits have been found on the edge of a large occupation hollow. Whether or not direct cultural links can be established between the two areas is problematic. Certainly their dates appear to be broadly similar and it may be that certain cultural traits were transmitted from one area to the area. However, more detailed analysis identifying a related group of shared cultural traits justifying any inference of cultural realtionships or diffusion is needed. It would appear, though, that the Chalcolithic of Cyprus may well have been the inheritor of two architectural traditions, one from the Neolithic of Cyprus itself and one from the mainland Levant. It is also clear that both had their roots within the much deeper and older traditions of the Levant. These traditions gave rise to the very distinct set of architectural forms which are the Chalcolithic buildings of Cyprus.

5.2 Patterns of Change in House Form.

With this scheme for characterising Chalcolithic buildings it is apparent that certain trends and patterns begin to emerge. A general architectural form associated with the Chalcolithic period has been identified above and used to distinguish architectural traditions which may have contributed to the Chalcolithic house-type. However, there are also two very clear and consistent groups of buildings which develop in a linear fashion throughout the Chalcolithic periods but along very different lines. These can almost be viewed as two divergent architectural trends within the general architectural form that is the Chalcolithic house. The first of these is the Lemba I Roundhouse which has its earliest manifestation in Area I at *Lemba* during the very early part of period 3a and survives, almost unchanged, into period 4 at *Kissonerga* with **B1**. The method of mudwall construction, the foundation hollow packed with clay or clay and rubble, and the roughly made rounded mud platform hearth are all quite characteristic as is the post-ring around the exterior of some of these buildings. The internal use of floor space does appear to change although the very badly preserved nature of **B1** makes an assessment of this aspect problematic. The survival of this building type throughout the very long Chalcolithic periods is intriguing and does caution us to the possibility of enduring traditions which can emerge unexpectedly on any site. This, and the sudden reappearance of the rectilinear house form late in the Chalcolithic sequence should indicate that we are not in possession of all the evidence and that very complicated group and cultural relationships may have existed at the time.

The second trend is much more complex and describes a very dynamic tradition of development, innovation and change which must reflect underlying changes within Chalcolithic society. This is the bilinear chronological development from the Mylouthkia Roundhouse, to the Kissonerga Roundhouse, and the Kissonerga Hall along one path and, a second contemporary path flowing from the Mylouthkia Roundhouse to the Erimi Roundhouse and finally to the Lemba II Roundhouse. Within these two strands of development the basic elements of the Chalcolithic house: the foundation hollow, the stone and mudwall construction, the central platform hearth, and the internal division of space are all preserved but expressed in different manners. The organisation of space within the building appears to be the key element of differentiation between the two strands of development. In the second strand the informal use of space based on the habitual placing and storage of artefacts is reflected in a more fluid room arrangement with no formal boundaries and a tendency for buildings to exhibit divergent functions and internal feature arrangements. The first strand, on the other hand, is characterised by a very formal organisation of space with specific floor types constructed in similar positions, strict and consistently placed floor divisions or walls, and a greater similarity in layout or plan between the buildings. The impression is that buildings were being used in a much more complex manner and were being required to fulfil a greater variety of functions under the one roof. These are two conflicting attitudes towards the house which are most clearly expressed during period 3, the MChal. It is interesting that this was also the floruit of Chalcolithic culture in the W of Cyprus with the development of very distinctive pottery and iconographic traditions which do not survive into period 4, the LChal. By that period the underlying causes which gave rise to the spectacular architecture of the MChal period had come to an end and these buildings were no longer produced. During period 4 the building tradition epitomised by the Erimi Roundhouse survives as the Lemba II Roundhouse but the complex use of space evident in the Kissonerga Hall is handed down to be expressed as the specialised use of buildings in building groups or homesteads, a pattern which is most clearly seen in the final phases at *Lemba*. This is the inception of the most characteristic and enduring building form of Mediterranean housing, the Courtyard House. This trend from simple, heterogeneous housing in early period 3a to more complex arrangements in period 4 is hinted at by Peltenburg (*LAP 1*, 313ff) where the two extremes are in evidence from the *Lemba* excavations. The evidence from *Kissonerga* has now gone some way towards filling that intervening gap and providing an insight into the mechanisms which may have affected that change. Obviously, this thesis will need substantiation through a study and analysis of patterns of function, discard and use within these buildings to determine if the types of differences expressed above can be seen. There is doubt, however, that the evidence from many of the buildings at *Kissonerga* can ever be used in this fashion.

Allied to changes in the complex use of buildings are changes in the types of materials used and methods of construction employed between the various periods. Walls, in particular, are seen to change from period 2 rubble core and mudwall, to period 3a mudwall on a stone plinth to period 4 where stonewall and mud predominate. There are many reasons why materials and construction methods change through time. The denudation of the landscape or increasingly restricted access to certain resources can force such changes on society. The change from timber to stone or a decrease in wall thickness may reflect such a process. However, it is difficult to see this as an underlying mechanism in Chalcolithic society where earth and stones must have remained in constant abundance throughout the period. The introduction of new ideas or the arrival of immigrants may also trigger such changes but, again, the archaeological evidence does not support such a proposition. Alternative reasons must be sought and the simplest explanation of internal development is the most attractive. Obviously, the architectural tradition within Chalcolithic society is dynamic and innovative making way for improvements where these may be necessary. The development of mud technology requires considerable knowledge and experience to achieve some of the more spectacular expressions of its capabilities. Mud plasters and earth-built walls are not simple achievements. It has been shown above how much of this technology could have been inherited by the prehistoric peoples of western Cyprus but this does not explain the expertise and skill which are inherent in the construction of buildings such as **B2** or **B206** at *Kissonerga*. The changeover from rubble and mud of **B200** at *Mylouthkia* or the mudwall houses of area 1 at *Lemba* to the well-built stone foundations and mudwall of period 3 is a development in building technology in which greater care and skills are being expressed and an understanding of aspects such as damp-proof coursing are being demonstrated. In this vein, the emergence of the technique of stonewall construction during period 4 should not be seen as a loss of earlier technologies but as the development of a very efficient and stable form of construction. The use of smaller stones with thick mud courses is quite a practical method which makes the best use of available materials and can be accomplished more easily by one or two persons than the earlier methods of mudwall or rubble and mud. Entrances and hearths are two elements which are also seen to develop and become better constructed and in a more regular fashion. By period 4 the doorway appears to have become more formalised and is quite a diagnostic feature of buildings of that period. The same is true of the hearth which has become a very well-built feature of most buildings.

The changing use of plasters is also an important development in Chalcolithic building technology and marks a significant change in technical abilities. Mud plasters and renders were developed and used successfully throughout the entire span of the Chalcolithic periods but it is only in period 3b that there is clear evidence for the use of a true lime plaster. In both the periods bracketing this, periods 3a and 4, there is a type of clay plaster which has been mixed with either crushed limestone or a very degraded type of lime plaster. It will be necessary to collect better samples and to carry out further analysis before this can be established either way. However, it is significant that such an elaborate technology is associated only with one class of building, the Kissonerga Hall and some of the early examples of the Erimi Roundhouse. This is a remarkable restriction in application of such an important and potentially useful technological achievement.

There are two other aspects of social behaviour detectable in the archaeological record which further set this group of buildings apart. An argument has been made earlier[9] for the idea that there was a formal area within some of these buildings which acted as a focus for ritual or non-domestic activity. This was at the back of the building directly opposite the doorway beside the radial floor division. It is seen quite clearly in **B994**, **B2**, possibly **B4**, **B1** at *Lemba* and in the building model itself. An earlier example of such an area of ritual focus may also come from the period 2 building, **B200**, at *Mylouthkia* in which at exactly this position a mud and stone built pier projects from the wall. In each case a distinct but different type of deposit or marker sets this area aside from other deposits within the buildings and highlights an aspect of cultural expression which is rarely seen. Peltenburg (*LAP* II.2, 106) also sees a similar treatment of space in the LNeo at *Vrysi* which is carried through to the EBA where it is expressed in the Vounous Model (Peltenburg 1994). This is clearly an important aspect in the consideration of the Kissonerga Hall type of house.

In the discussion of the *Kissonerga* building model (*supra*, 15) evidence is also brought forward to suggest that it was deliberately damaged and concealed along with many of the associated artefacts. The projections above the doorway were broken and gouged out, the tenon on the door itself was broken, the brackets inside the model were snapped off and the whole vessel was coated in a thin layer of fine, white clay. This treatment was also applied to some of the associated figurines and artefacts before the whole group was deposited in a pit immediately prior to the construction of **B994** directly over it. The activities associated with the deposition of the model are interpreted as an act of concealment or ritual destruction of an important set of cultural artefacts. Peltenburg, on a number of occasions (1988c, 1991a, 1994), extends this observation to behaviour associated with the abandonment of the buildings themselves and sees rituals of closure in the number and quality of artefacts on the floors of buildings at both *Vrysi* and *Kissonerga*. This proposition can be developed along much more explicit and restricted lines. A study of the plaster fallen from the wall of **B206** at *Kissonerga* reveals repeated applications of a fine lime plaster to the walls in varying shades of red, pink or white. This can happily equate with refurbishment of the interior of the building on numerous occasions and may reflect the development of different patterns of decoration. However, the final exposed surface of the plaster was covered in a very different material of a fine buff/cream coloured clay which appears to have been applied to the plaster surface while *in situ* on the wall. This bears remarkable similarity to the treatment of KM1446. There is also the question of cultural material, particularly ceramics, lying on the floors of the buildings. This occurs regularly in many Chalcolithic

[9] See the discussion under the building model KM1446.

houses of all periods but amongst those of the Kissonerga Hall type it has an added dimension; it is deliberate. In **B206**, **B855** and **B994** complete pottery vessels and other artefacts are found lying smashed directly on the floors of the buildings with no intervening erosional or collapse deposits between the vessels and the floor. This is in contrast to other types of buildings, for example, **B3**, in which vessels appear to "float" in eroded materials above the floor. Such an unusual occurrence can be explained by normal site formation processes in which objects do not remain static as deposits build up but rather interact with them and move, frequently losing contact with the floor on which they originally sat. For artefacts to be found consistently directly on the floor requires an alternative explanation which implies deliberate placement and rapid burial, possibly intentional. The deposits inside **B994** are also unusual in being identical in consistency and colour to that of the wall itself. This aspect of the deposits within the building is not in keeping with observations of the types of deposits expected from natural processes of site formation. There are no obvious deposits from roof collapse or erosion and there are no obvious wind borne or water laid deposits form gradual site build up. It reflects, instead, a very rapid accumulation of material in a form which implies that the wall was destroyed and deposited over the floor of the building. The conclusion that this was the result of human actions is tempting and adds further to the notion of ritual activity. The deliberate placement and breaking of vessels on the floor, the clay-wash over plaster surfaces and the evidence for the dismantling of walls all point to specific behaviour associated with the abandonment of buildings of the Kissonerga Hall type. This is not observed in other building types where other forms of abandonment must be concluded.

The two main strands of architectural development during the Chalcolithic period are, therefore, seen to evolve along very different lines within the general tradition of the Chalcolithic building. Two distinct architectural forms are seen to develop. The emergence of complex building organisation during period 4 with differentiation in size and function becoming more apparent and the grouping of structures into "compounds" may herald the establishment of that most characteristic of vernacular Mediterranean house types; the Courtyard House. Developing alongside this is the Kissonerga Hall which is characterised by size and quality of materials, the formalised organisation of internal space, an area of ritual focus and, elaborate abandonment behaviour. It is tempting to see the continuation of this architectural form into the EBA with the Vounous Model and further into Cypriot history as the forerunner of the temple or shrine. Peltenburg certainly sees this as a possibility (*LAP* II.2) but this view must proceed with some caution and other traditions which may have influenced the development of Bronze Age religious practices and architecture must be taken into consideration.

5.3 Lime Plaster Production.

It is curious that the production of lime plaster did not appear in Cyprus until so late in the prehistoric sequence many thousands of years after it had reached its floruit in the Levant. There may be cause to suggest that it emerged in the MChal in Cyprus as a result of internal cultural developments but this would surely be ignoring the clear contacts which existed between the Ghassulian/Beersheva complex in the Levant around 3500BC and the EChal sites of the island. That it was involved with a specialised building type has been demonstrated and there is always the danger that similar buildings also existed in periods 2, 3a and 4 but have not yet been located. However, on present evidence, the technology does appear to emerge only in the middle of the Chalcolithic sequence and it may well be that it is somehow tied in to the development of the Kissonerga Hall buildings sequence. Certainly groups of cultural traits can be transmitted between cultures as part of a complex of related beliefs, behaviour and artefacts. It may be tempting to see this happening during the MChal with the Kissonerga Hall and its associated features reflecting such an occurrence. Whatever the nature of that link may be, though, can only be a matter of speculation and it may be prudent to await the uncovering of further evidence before such speculations are voiced.

Experiments with the production of lime plaster floors and wall finishes has provided an insight into some aspects of the technology which has relevance to considerations outwith Cyprus. The lime plaster industry is thought to have emerged as a complex industry during the Natufian phase in the Levant with evidence of lime plaster kilns coming from the site of *Hayonim Cave* dated to c10,400-10,000 BC (Kingery *et al* 1988, 223). There is some evidence that it was known by at least the epi-palaeolithic Geometric Kebaran (c12,000 BC) although it had limited application and was only widely used later on in the Neolithic. Rollefson *et al* (1992) observe that by the PPNB phase in the southern Levant the use of lime plaster for various architectural features, particularly floors, "*...was a virtual dictum...and this entailed a colossal drain on local stands of trees for fuel.*" (1992, 468). They see a link between the requirements of lime plaster production and animal husbandry as being key elements in the dramatic changes which were affecting society and the environment during the PPNB-Yarmukian sequence at *'Ain Ghazal*. They argue that deforestation to produce fuel for lime plaster production made more land available for grazing goats which kept the fragile soils exposed to constant erosion and degraded the landscape to such an extent that agricultural potential was diminished and patterns of settlement collapsed. The increasing scarcity of fuel and timber dictated the abandoning of lime plaster production and initiated changes in settlement and building types. As evidence for this they cite the increasing reduction in post size between the PPNB and the PPNC from on average 50.0-60.0cm to an average of 15.0-20.0cm. A corresponding reduction in room size is also explained by the lack of suitable long timbers to span the greater widths of the earlier period buildings. Floors were also made from a mixture of mud and crushed chalk or small quantities of lime. Estimates of the amount of lime plaster in use during the Neolithic of the Levant are indeed impressive. Ronen *et al* (1991) have analysed floors from the Neolithic village of *Yiftahel* in the southern Levant and estimate that quantities of 1.6 tons for a thin plaster floor up to 7 or 8 tons for a thick floor are not uncommon. They describe floors with a layered structure and a high density finishing or surface layer which has been compacted and smoothed with a float. Chemical and X-ray analysis of numerous plasters by Kingery *et al* (1988) indicate that this tradition extended from the S Levant up to S Anatolia during the Neolithic. They also assert that the firing of limestone to make quicklime requires heating at high temperatures of

800-900^{o}C for several days with the consumption of 2-4 tons of fuel for every ton of quicklime produced. If this is the case then clearly vast amounts of timber would be required and the picture of massive deforestation proposed by Rollefson *et al* could well have been true. It is, however, based on a misunderstanding of the nature of prehistoric plasters.

Microscopic analysis of lime plasters from sites in the Levant by Goren *et al* (1991) has revealed that previous analysis based only on chemical identifications can be misleading by failing to distinguish between limestone and lime plaster both of which appear as $CaCO_3$. It is the appearance of the crystals and the presence of microfossils under the microscope which can determine composition of the plaster and the extent of the use of true burnt lime. In many cases they were able to determine that burnt lime formed a much smaller percentage of the total bulk of the plasters than was thought to be the case with 30% being a more realistic figure for most samples. They also suggest that firing temperatures for the production of lime were never as high or as prolonged as has been claimed. This alters considerably our perception of the picture of catastrophe painted by Rollefson *et al* and has significant implications for our interpretation of conditions in prehistory. The role of lime production in the process of deforestation and the view that such a complicated technology must imply craft specialisation are both called into question.

The contribution of experimental archaeology can go some way towards resolving this conflict. With the creation of a massive plaster floor and mural in RH1 at the LEV some expertise with the low level production of lime plaster was gained and a knowledge of effective quantities and methods of production was developed. It has been shown how a very solid and authentic floor can be created using large amounts of crushed limestone and cobbles for the foundation and by reducing the lime content of the plaster paste by up to 50% through the addition of ground kafkalla without reducing the effectiveness of the final product. Indeed, the creation of a floor foundation and plaster in this manner produces a more durable surface than would be the case if a very pure lime plaster was used. This would not have the stability afforded by the addition of an inert filler nor the strength provided by the cobble and grit foundation. The massive lime plaster floors at *Kissonerga* and *Lemba* do appear to have been constructed in this manner with a stone base set in a matrix of low density lime plaster with grades to a higher density nearer the surface indicating working of the material while still damp to bring the finer elements to the surface. An analysis of one sample by Goren (appendix 3) also indicates large amounts of uncalcined lime within the paste as well as the addition of an inert material such as powdered limestone or kafkalla. This he explains as a deliberate addition or as a result of incomplete calcination of the limestone during the firing process. Certainly our experiments with kiln firing bear this out quite well where suitable temperatures were only maintained for very short periods of a couple of hours and in which most of the fired material had to be pulverised together before slaking resulting in the inclusion of uncalcined powder in the quicklime. By mixing this with 50% powdered kafkalla the total lime content was further reduced and was probably much nearer 30% by the time it was laid as a floor. The quantities of fuel used were also roughly equal to the amounts of stone being burned rather than the 2-4 times greater suggested by Rollefson *et al* and Kingery *et al.*

Therefore, by decreasing the amount of fuel used through shorter firing times and by reducing the total amount of lime paste in the plaster, a large floor and other fixtures with an estimated volume of 1500 litres (c12000 kg) was created using only 408 litres (c3264 kg) of lime paste and the equivalent in fuel of one small tree. It was also carried out easily by two persons with no experience in this technology but with some knowledge of modern plastering methods.

Such experiments hardly give confidence in the claims of massive deforestation as a result of lime plaster production or in the underlying assumption of craft specialisation being made by Rollefson *et al.* Clearly, these massive floors and plaster fixtures were important features in prehistoric architecture in both the Levant and Cyprus but they were, by their nature, long-lived elements of these buildings and would only have been made from time to time. The demands on local stands of timber would have been negligible and could realistically have been achieved through scavenging and through the daily channels of fuel procurement. In the area around *Lemba* it is possible to collect branches and discarded timber from mature groves and stands of trees. The situation in prehistory would have been equally straightforward where, despite greater demands on timber for fuel supplies, the lower densities of settlement would have ensured larger stands of natural forest cover within walking distance of the site. The rate of replacement of buildings in prehistory and the frequency with which new ones were constructed cannot accurately be gauged. However, it is known that buildings such as the ones found in Cyprus and across the Levant can have a very long lifespan of hundreds of years with careful maintenance. Even with replacement on a 20-30 year cycle and the addition of several new structures to the site on an annual basis, the construction process did not place great demands on society. In any society the construction of a building on the scale of **B206** was a major undertaking but, as experience with experimental reconstruction has shown, this could be achieved gradually over a period years. Such a low level demand for house construction would also lead to an equally low level of demand for plaster production. This is not a situation which would argue well for craft specialisation in which demand must be high in order to justify the concentration of a few individuals in one area of production alone. Admittedly, specialisation can exist on a more periodic basis with certain individuals being responsible for certain task within a society over and above their more routine involvement in daily activities. The specialist architects amongst the Batamalibia are a good example of this. However, Rollefson's argument that wealth and labour within society were organised to support specialist craftsmen cannot be sustained on the basis of the lime plaster industry alone.

By investigating the realities of lime plaster production through experimental archaeology at the LEVand with the help of the analyisis of prehistoric plasters by Goren (*et al* 1991 and appendix4) the role of the lime plaster industry as the mechanism of deforestation, environmental degradation and agricultural change as well as its place in society as a focus for craft specialisation is called into question. The links between these aspects of prehistoric society in the Levant must now be set aside and a new framework proposed. It is tempting to see craft specialisation appearing during the early Neolithic with the benefit of hindsight from later periods. However, other modes of production within society must be investigated. The whole question of environmental change is also a highly complex and contentious issue which cannot be assigned to any one cause whether it is man-induced or natural. A variety of contributory factors and resource-use patterns or strategies should be considered to give a more balanced and useful picture. This can only be done within the context of long-term and broadly based projects of field-work and research in the Middle East.

5.4 Site Formation Studies and Prehistoric Buildings.

Much of the foregoing discussion on prehistoric buildings is dependent on a better understanding of the types of materials and methods used in their construction. It is only by achieving that understanding that a firm identification of building types can be made and a clearer picture of changes and developments within an architectural form can be seen. The basis for that understanding lies in the painstaking and thorough investigation of building materials and elements within their archaeological context. A system has been proposed which allows this work to be carried out in the field to achieve a certain level of analysis which can be used to complement other studies and to focus attention on certain areas, field sections or samples which would most benefit from intensive laboratory analysis. The use of a calibrated 10x magnification hand held lens was used in all the descriptions presented in the foregoing discussions. This allowed the examination in closer detail of the microstructure of building deposits and provided scales for the measurement of size and density of the different elements and structures. Although it is not argued that this should be the sole means of assessing sediments, materials and deposits on a site it does provide a simple and efficient tool for achieving a better understanding of the site. It can also be learned with reasonable ease and when linked to a study of local conditions of site formation can be quite informative.

Courty *et al* (1989, 104ff) have classified and described the key identifiable aspects of various building materials and anthropogenic deposits found on archaeological sites. However, each site or area will need to establish its own set of criteria in relation to local soil and weather conditions. In this respect, experimental archaeology has been of great value in producing modern materials which can be used as a comparative standard for the examination of prehistoric materials. It is important in any long term project that such a set of standards be established early on as a reference collection of materials expected from the site. The use of ethnographic evidence linked to a study of erosional and site formation processes will also help with the understanding of non-structural aspects of archaeological deposits on site. Both of these aspects of study have now been established for the LAP although the completion of a reference collection of stratigraphic sequences will take some time. The delineation of a classic sequence of natural erosion and destruction of a mud building has been described with the excavations at *Souskiou* where both an external and an internal sequence was investigated (appendix 2). That study has also helped to identify the types of erosion and decay which affect buildings and lead to their incorporation in the archaeological record. It now remains to substantiate this further with other similar sequences and to identify and excavate deposits resulting from catastrophic collapse, burning, and building replacement. Work at both the LEV and at *Souskiou* will continue to fulfil this aim. However, a characterisation of the key elements of common building materials has been presented above and can be summarised briefly.

Mudwall. The types of soil used for this construction technique are generally of a low clay content and are poorly sorted with a heterogeneous mix of silts, fine and coarse sands and, lighter gravels. These are small-medium sized sediments and are mixed irregularly, with pockets and clasts of sands and clays being common. The mixing process does cause the clay to reform and create weakly developed internal structures of bridges, lamina and whorls. These need not be structured parallel to any surface and can form around larger elements within the mud sometimes in a concentric pattern. Voids and air bubbles are also quite common and are a very characterisitic feature along with the casts or elongated tubular voids left by the decayed organic material. This can constitute up to c30% of the total volume of the mud and are organised in a random fashion reflecting the mixing process. Surfaces, where they survive, are quite informative and can indicate the application of the material in a fairly moist state by retaining the impressions of stones, grasses etc. If the surface has been exposed to weathering or has been smoothed immediately after the application of the mud then a finely structured series of clays lamina will be in evidence. Any erosion will destroy all these internal structures and will lead to a sorting of the material from which the mud is made into natural layered sediments.

Mudbrick. These are generally quite similar to the structure of mudwall but in clearly defined shapes which come in a variety of sizes. The smaller size of the bricks and the fact that they are dried before inclusion within the wall means that a much higher clay content can be employed without fear of massive shrinkage. This will be reflected in the internal structure of the brick. Greater compaction of the mud is also achieved by compression within the mould or in the hand. The surface of the brick should have a finely laminated clay micro-structure which may be the clearest indication of its presence. Mud mortars need not be dissimilar from the brick itself and may only be distinguished by the lower state of compaction, the absence or low amounts of organic material and the cleavage plain between the surface of the brick and the mortar. An eroded mudbrick wall will be similar to that of mudwall although in the initial stages it may still be possible to detect the mortar/brick distinction as a faint pattern.

Pisé. This is constructed from a very different type of soil material and may have a very high clay content. The soil is generally very well sorted with few elements larger than the coarse sands being present and is characterised by a total absence of any organic material or internal clay structures. An intact piece of wall will retain the graded series of compaction surfaces from its construction which will appear as superimposed layers a few centimetres thick which are denser towards their upper surfaces. An eroded pisé wall will be indistinguishable from the surrounding deposits.

Floors are, on the whole, difficult to distinguish with great certainty except when a clear plaster is being used. Most floors result from the degree of traffic over an area and are largely the result of compaction of the upper few millimetres of the ground surface. This can be quite thin (< 1.50mm) and will be very roughly smoothed from wear with weakly structured clay lamina forming and giving the appearance of a firm surface. The general compaction rarely extends more than 10.0-20.0mm deep and is graded downwards in degree of compaction resulting in a distortion of the soil structure to form planar shaped blocks and voids. There also tend to be fewer voids in the upper more heavily compacted layers. Cleavage planes may develop between the densely compacted surface and the underlying deposits giving the impression of a laid floor surface. Evidence of root and insect burrowing activity extending down from the top are excellent clues to the presence of a surface although interior floors may not be affected by this type of action. Bioturbation and trampling will also result in smaller cultural artefacts being incorporated in the first few centimetres of a surface rather than being concentrated on the surface itself. Puddling can create strongly laminated surfaces and can create a porous fabric which will become infilled with very fine sediments. The burial of a floor will return it to natural soil formation processes which, in the long term, will destroy many of the structures and patterns described above.

Plasters. The basic clay plaster is a very distinct and strong material which is composed of quite a pure clay soil and may contain large amounts of organics preserved as casts and voids. These tend to be orientated parallel to the surface. The application of the clay plaster will result in the formation of very strong bedded laminations parallel to the external surface giving it a smooth, burnished appearance which can be confused with a true lime plaster. Renders are of a less pure material and have a coarse sand content with large amounts of organic inclusions. The material tends not to be so well worked into the wall and as a result the clay structures are less pronounced. There should be a strong cleavage between the plaster or render and the wall surface upon which it has been applied. Plasters made from lime or gypsum are quite distinct and are characterised by the high calcite content, the complete absence of organics and, the lack of any internal structures. Working of the plaster during its application will result in a gradation effect with the finer elements being brought to the surface to form a very hard smooth finish. Fragments of limestone or partially calcined lime and some coarse sands may also be present within the dense calcium fabric of the plaster. Burial of a plaster floor or wall plaster can result in decalcification and the deterioration of the material into a powdery white mass.

Roofing. This is the most difficult aspect of a building to identify unless exceptional circumstances prevail. The presence of burnt clays impressed with reeds, the ashy traces of burnt timbers or large amounts of wood plant and straw remains detectable in thin section are about the only clues which can survive. Several examples of the types of burnt, impressed clays which can appear in building remains have been described in chapter 3.3 with the assessment of samples from various buildings at *Kissonerga*. In each case these samples have been classified as roofing material although they could equally have come from a flimsy wattle and daub walling. The absence of any other clear evidence for this type of walling, however, has meant that the material has been assigned the classification of roof as the most logical alternative. Its characterisitics are the same as that of other mud feaures; poorly sorted sediments with voids, organic inclusions, weakly structured clay formations and voids.

These, then are some of the key characteristics of some of the more common elements found on prehistoric sites in Cyprus and the Middle East. The primary concern for their identification and interpretation is the close observation using a calibrated 10x magnification hand held lens and the careful recording of the context and associations of the sample. This latter aspect involves attention being paid to the immediate context of the sample, its orientation, relationship to specific features and type of material within which it was lying. This can only be done in the field and, ideally, by the person carrying out the identification. An overall strategy of sampling to detect differences or changes and to confirm isolated observations is also necessary to form a complete project. Several related sites should also be considered as there may be very localised differences or subtle chronological distinctions which can only be detected on a broader scale.

5.5 Summary.

Within the four main aims of the current research, most of the objectives have now been achieved. The longer term nature of the study of site formation processes means that this aspect in particular will require much more research and many more observations before it can be complete. The bewildering array of aspects and features which have emerged from many years of excavation have been assembled in to a usable scheme of building elements which have been used to identify eight specific building types in use during the Chalcolithic period. A tradition of construction in circular, free-standing buildings set into a foundation hollow, using mudwall construction and clay and lime plasters has been identified. This is also linked, in the early phases, to bell-shaped storage pits and underground tunnel complexes. The sole use of lime plaster in prehistoric Cyprus, which also has good sources of gypsum, is noted. These characteristics are linked to earlier developments which can be traced through the early prehistory of the southern Levant where circular, semi-subterranean buildings, the use of mudwall and lime plaster are common features. This tradition culminated in the Bersheeva-Ghassulian complex which, architecturally, bears strong similarities to the EChal period in Cyprus and may suggest common cultural links. This does not necessarily imply direct cultural contact or migration and may only be the result of the intricate transmission of a set of beliefs and ideas surrounding the construction of buildings. Common links in other spheres of both cultures must first be demonstrated before a more concrete association can be demonstrated. Within the traditions of Erimi Culture house types two parallel and interdependent lines of development were traced. The first of these saw the increasingly complex use of space and the trend towards building specialisation resulting in the emergence of building complexes which may be a prelude to the emergence of the classic Mediterranean and Middle Eastern domestic arrangement of the Courtyard House. The second line of development saw the emergence of the Kissonerga Hall building type characterised by quality construction, formalised use of space with floor divisions and massive plaster floors, an area of ritual focus at the rear of the building and, elaborate "ritual" patterns of destruction. It is tempting to see within this tradition the emergence of a specific "ceremonial" or "ritual" building form which may be the forerunner of the later Cypriot temples and shrines.

Many of the ideas about the form of the various proposed building types and about the building materials were first tested out experimentally at *Lemba*. From this it was possible to refine and develop those ideas in a realistic and solid fashion. Details about roofing, wall construction, doorway arrangements, plasters and floors have been worked out using this method. These have been described above. The site has also produced building materials made using predicted methods and with locally available resources which can be used as a reference collection to compare with prehistoric building materials. Further information has also been forthcoming from a study of the village of *Souskiou* information about building decay and site formation has been gathered. Excavations at both *Lemba* and at *Souskiou* have now produced classic archaeological deposition sequences derived from the construction of buildings (*Lemba*) and from their decay and collapse (*Souskiou*). Both of these sequences originate from known human activity, as is the case at *Lemba*, or from observed patterns of decay and collapse. Further sequences will be investigated in the future in order to build up a reference series of known deposits in order to understand prehistoric deposits.

The buildings of a society or culture are but one aspect to be considered when studying the past. This research has shown how the study of Cypriot Chalcolithic buildings can add a new dimension to our understanding of that period and, on a broader scale, can assist in our interpretation of archaeological sites in general. The schemes developed for classifying building elements and types and the method pioneered for investigating building materials have achieved this end.

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Fig. 1. Map of Cyprus showing sites mentioned in the text.

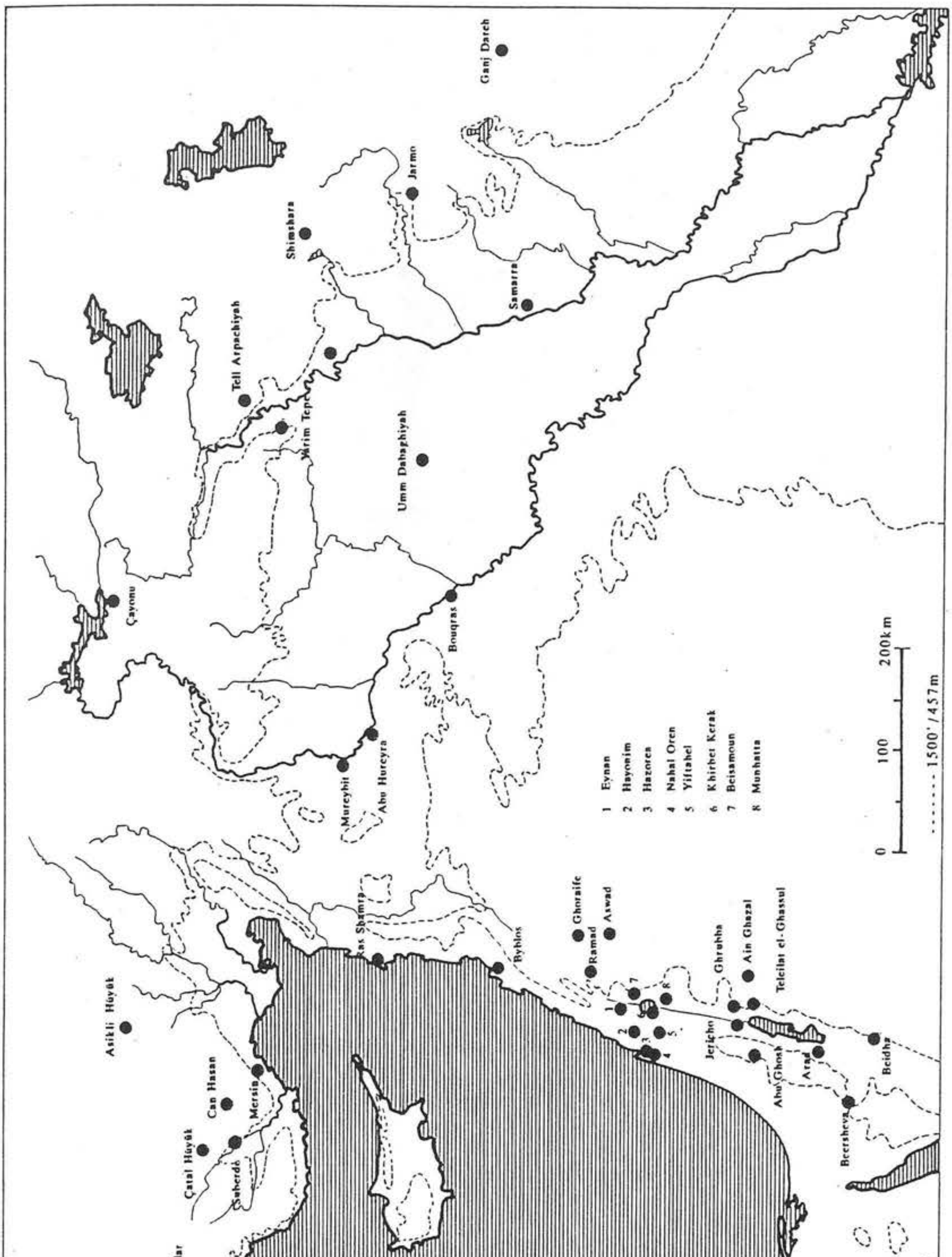


Fig. 2. Map of the Middle East showing sites menioned in the text.

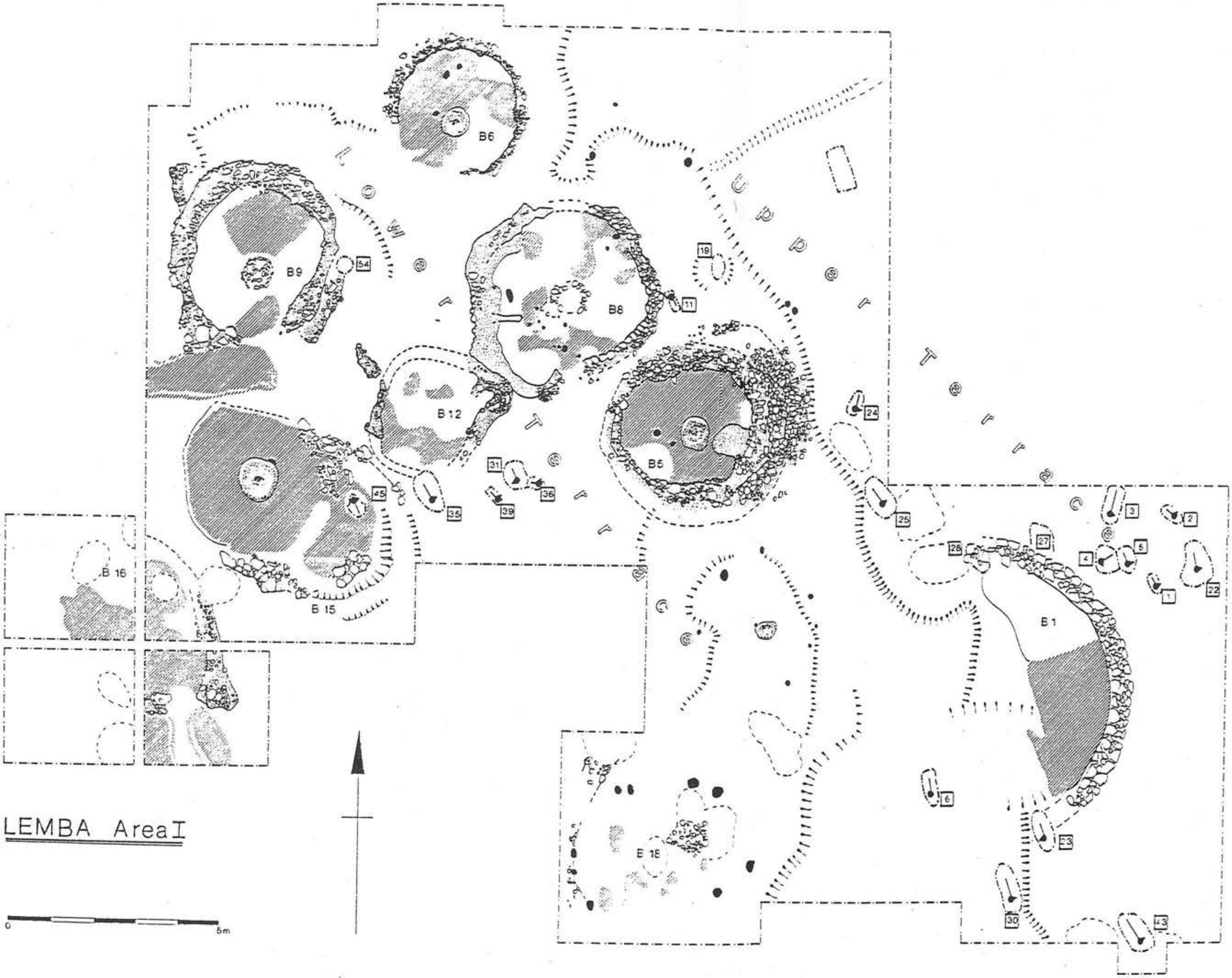


Fig. 3. Plan of Lemba Area I.

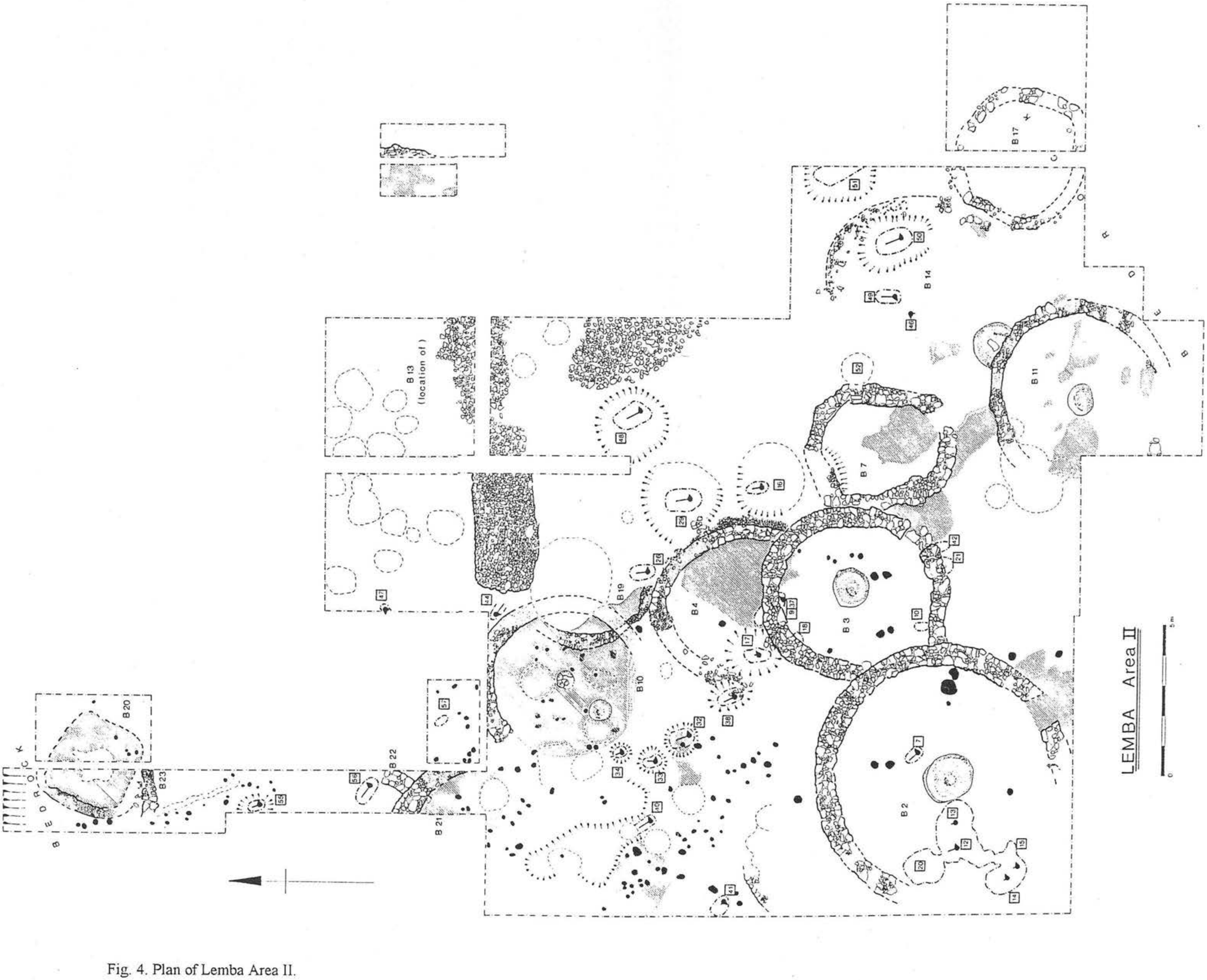


Fig. 4. Plan of Lemba Area II.

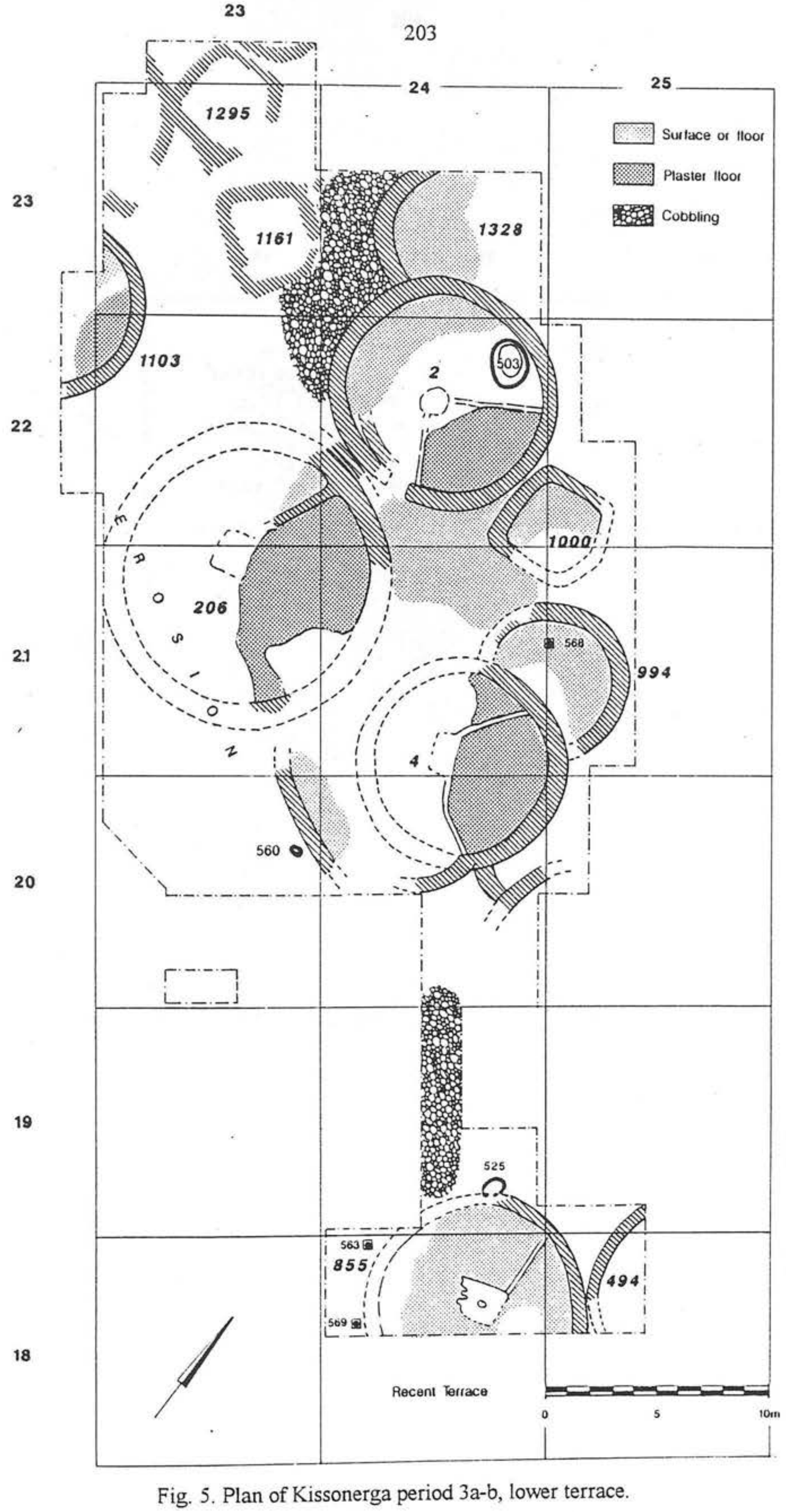


Fig. 5. Plan of Kissonerga period 3a-b, lower terrace.

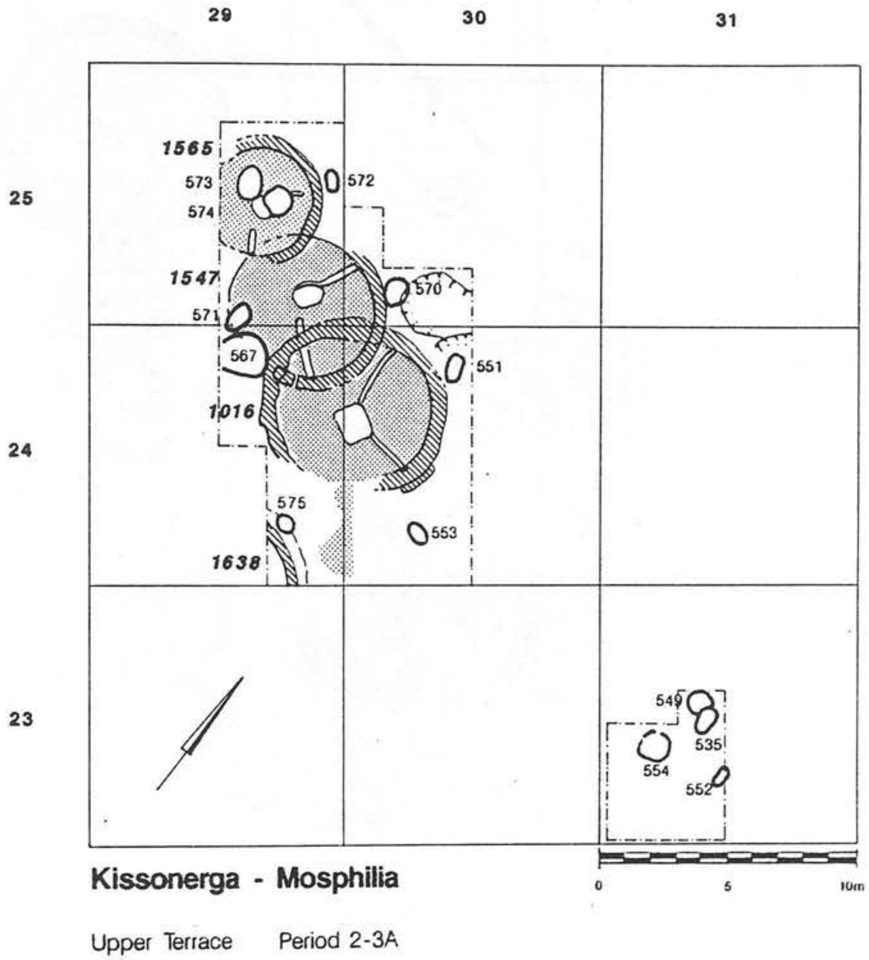


Fig. 6. Plan of Kissonerga period 3a, upper terrace.

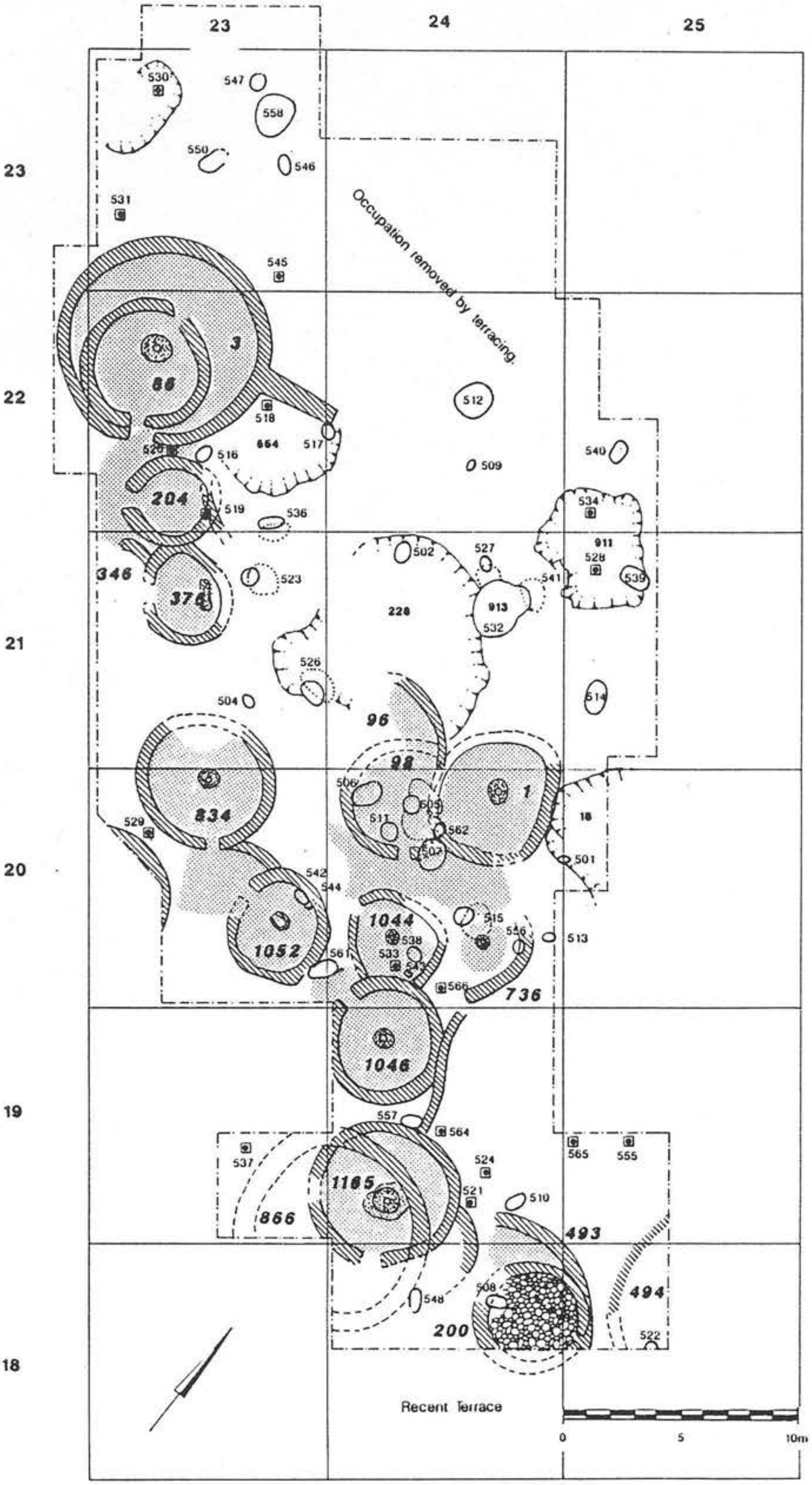


Fig. 7. Plan of Kissonerga period 4.

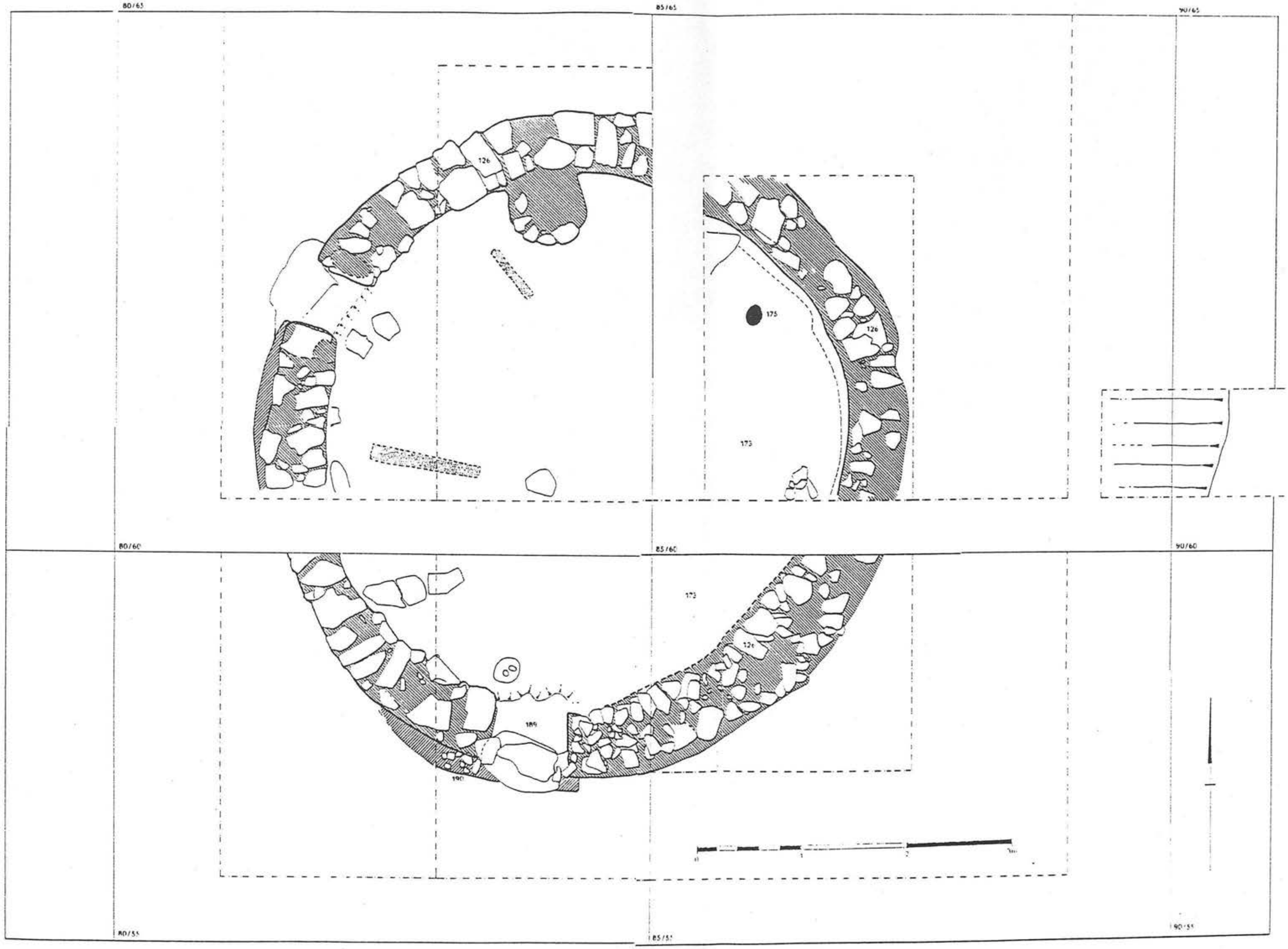


Fig. 8. Plan of Mylouthkia B200.

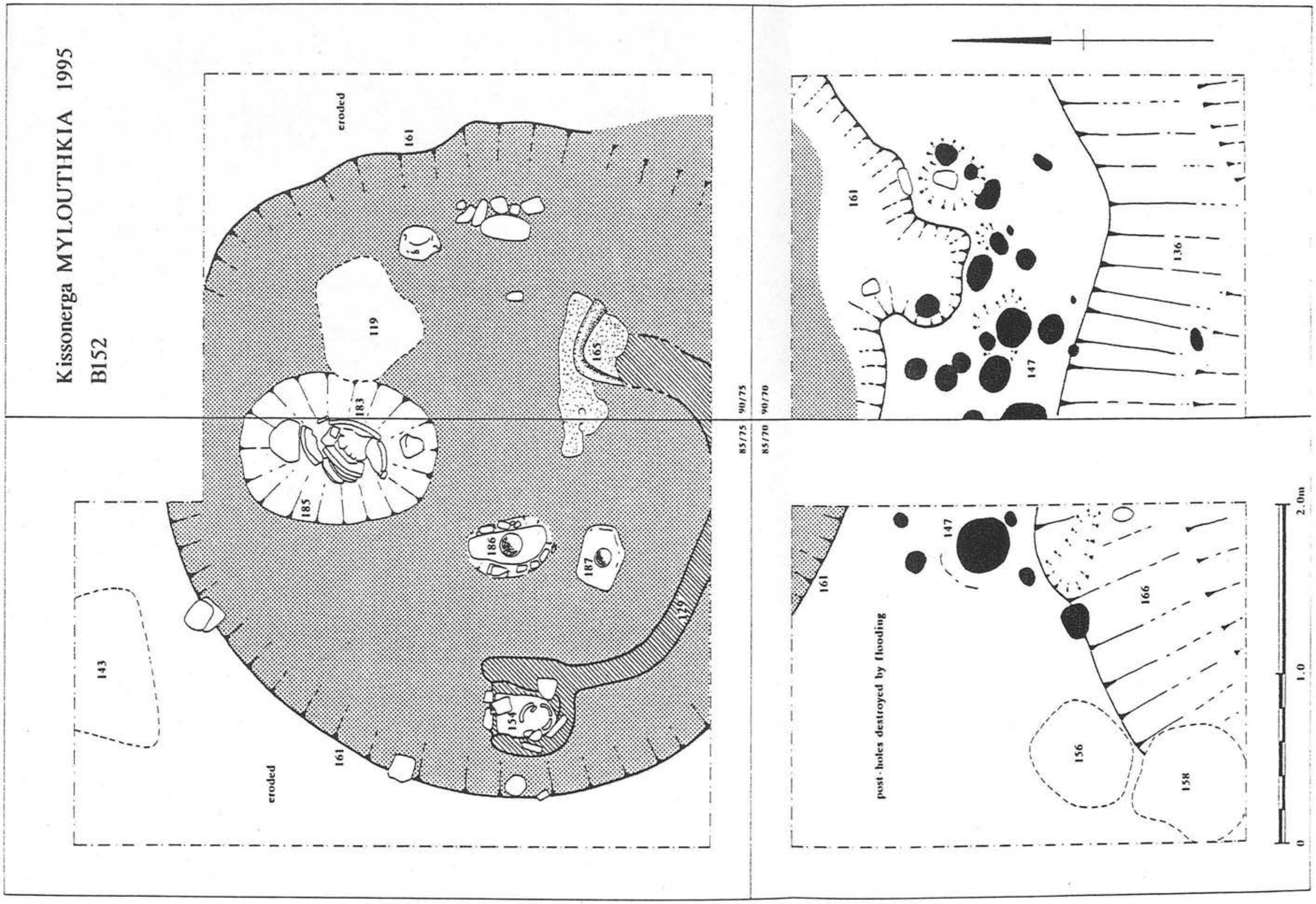


Fig. 9. Plan of Mylouthkia B152.

Fig. 10 Kissonerga Mylouthkia B200, view of blocked entrance fromW.

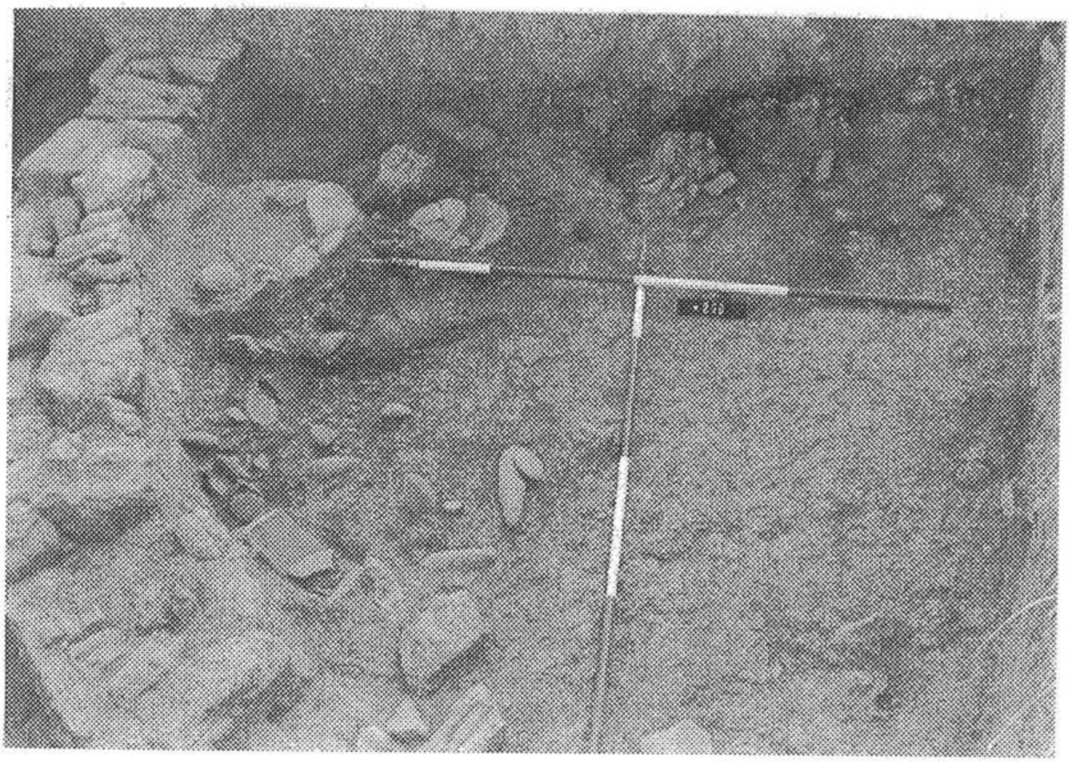


Fig. 11 Kissonerga Mylouthkia B200, view of NW sector showing pier at centre left against wall and the second entrance at the bottom of the photograph.

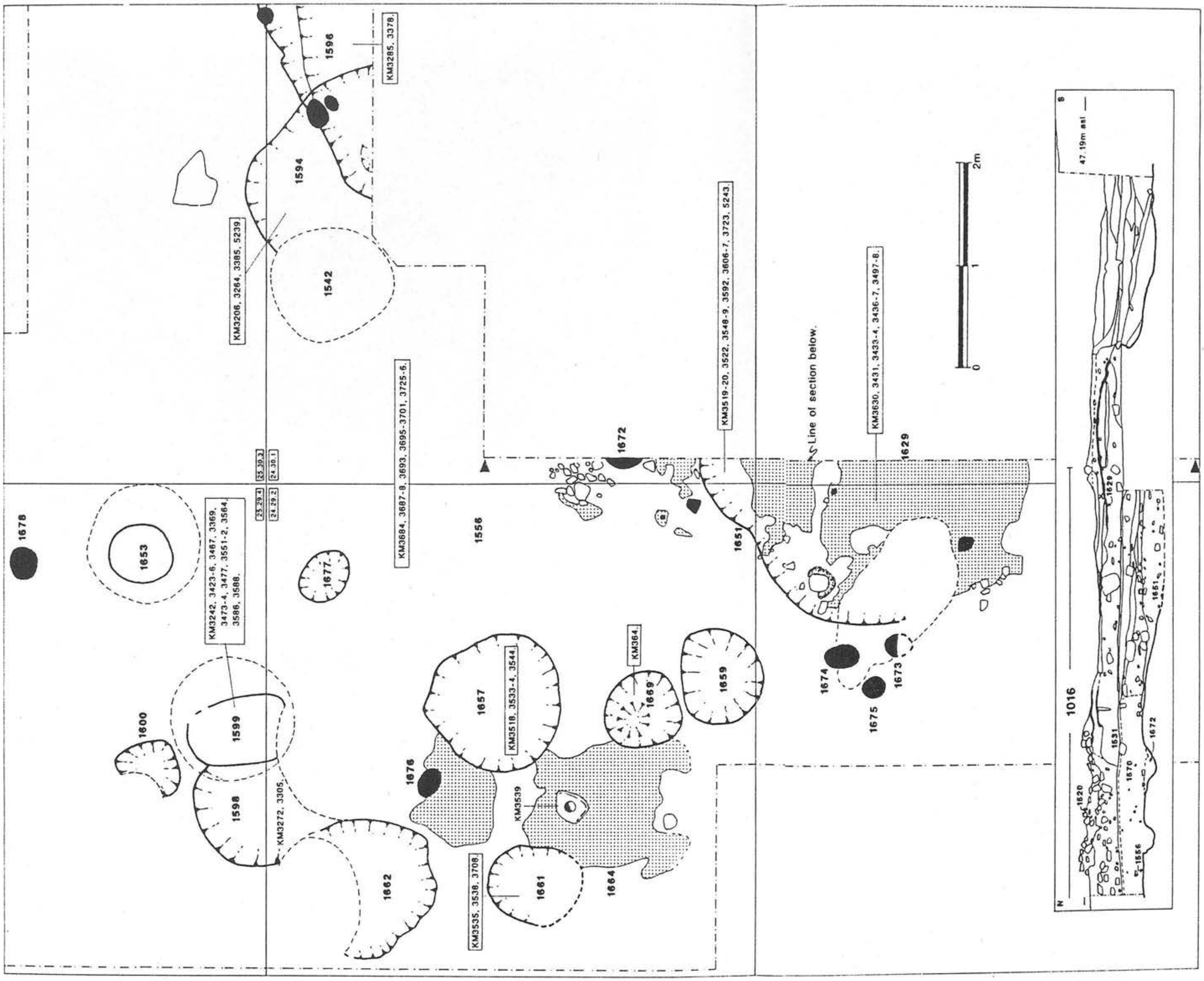


Fig. 12. Plan of Kissonerga period 2.

Fig 13 Lemba Area I, view from the W with B9 in the foreground, B5 in the centre and B1 the back of the excavations.

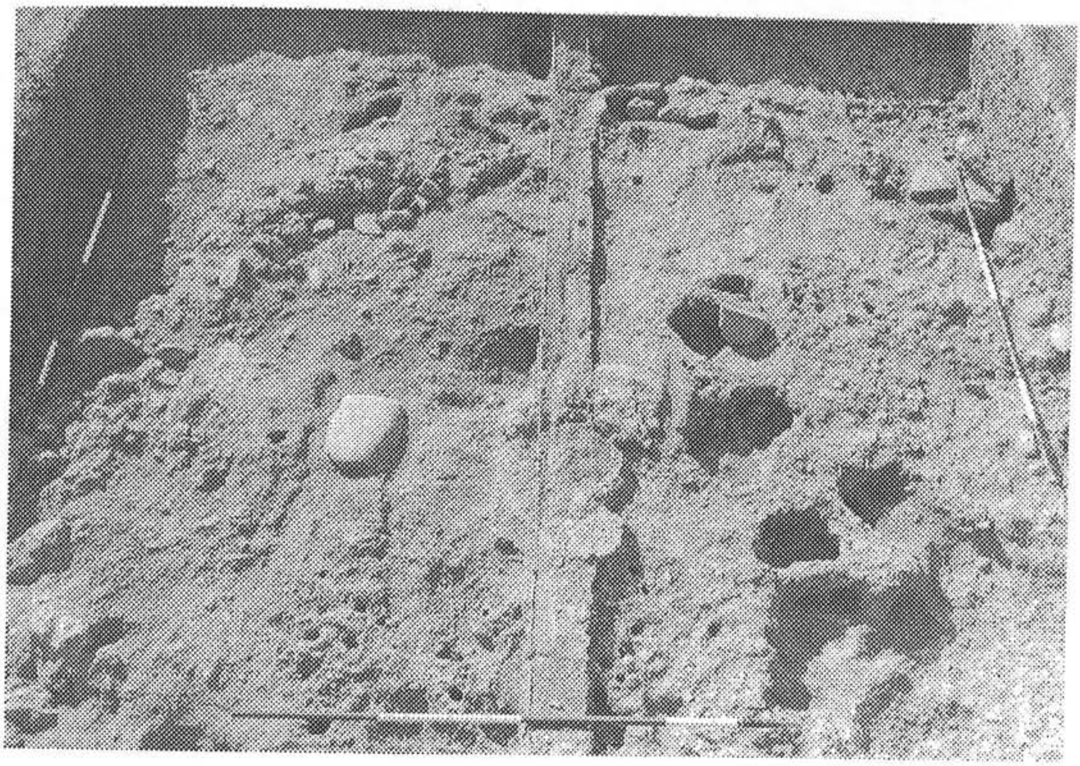


Fig 14 Kissonerga B1, view from the S showing the N arc of wall, the plough scarred floor and the hearth at the centre in the baulk.

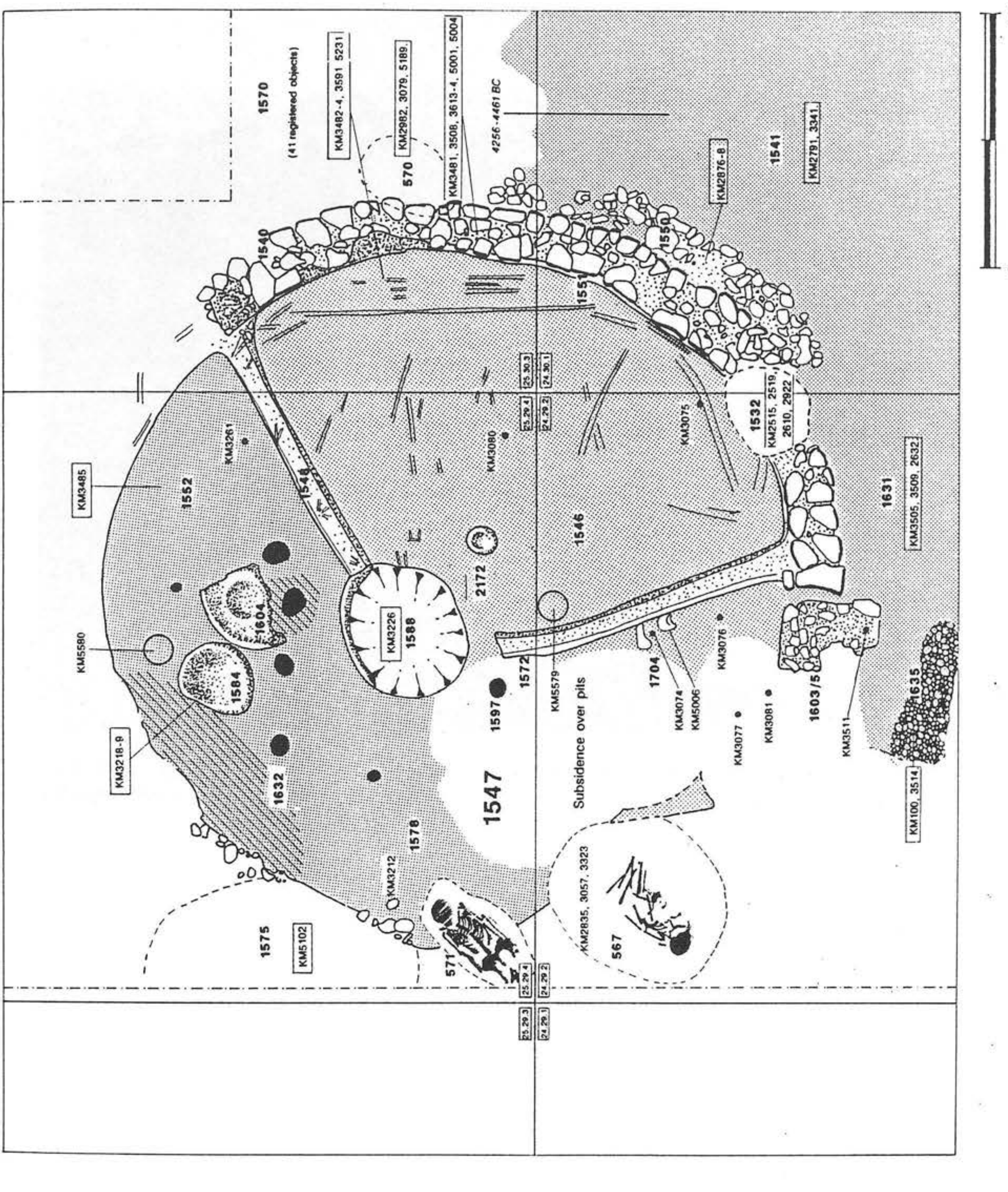


Fig. 15. Plan of Kissonerga B1547.

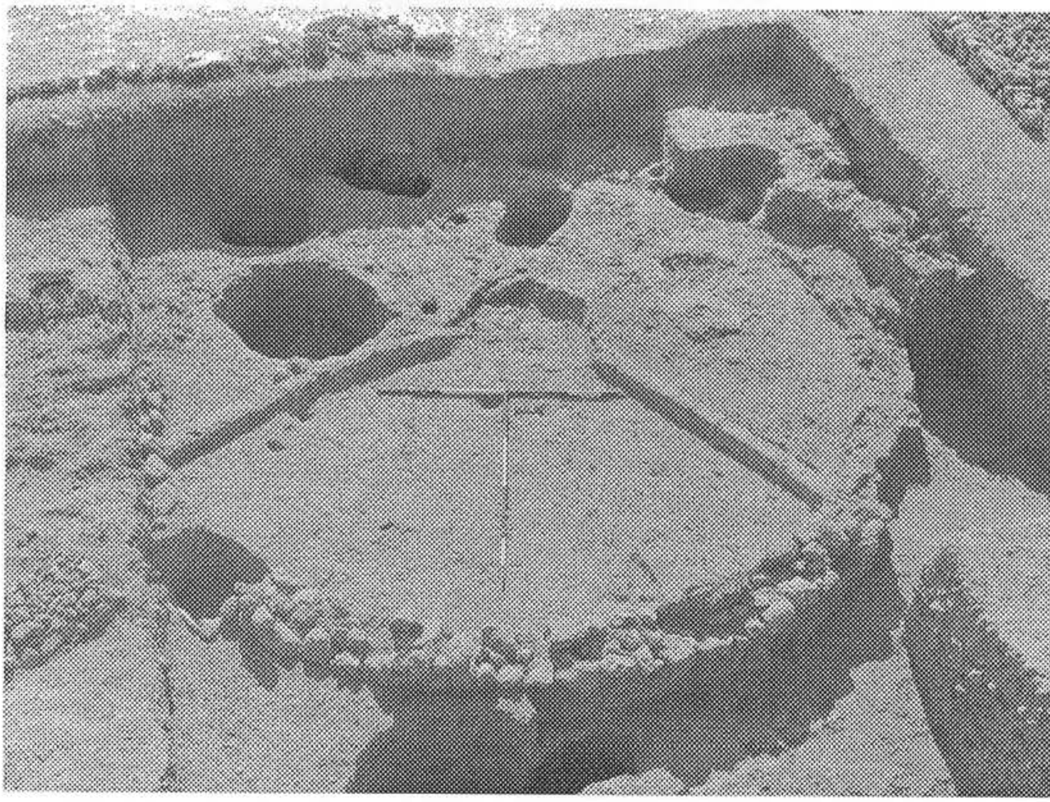
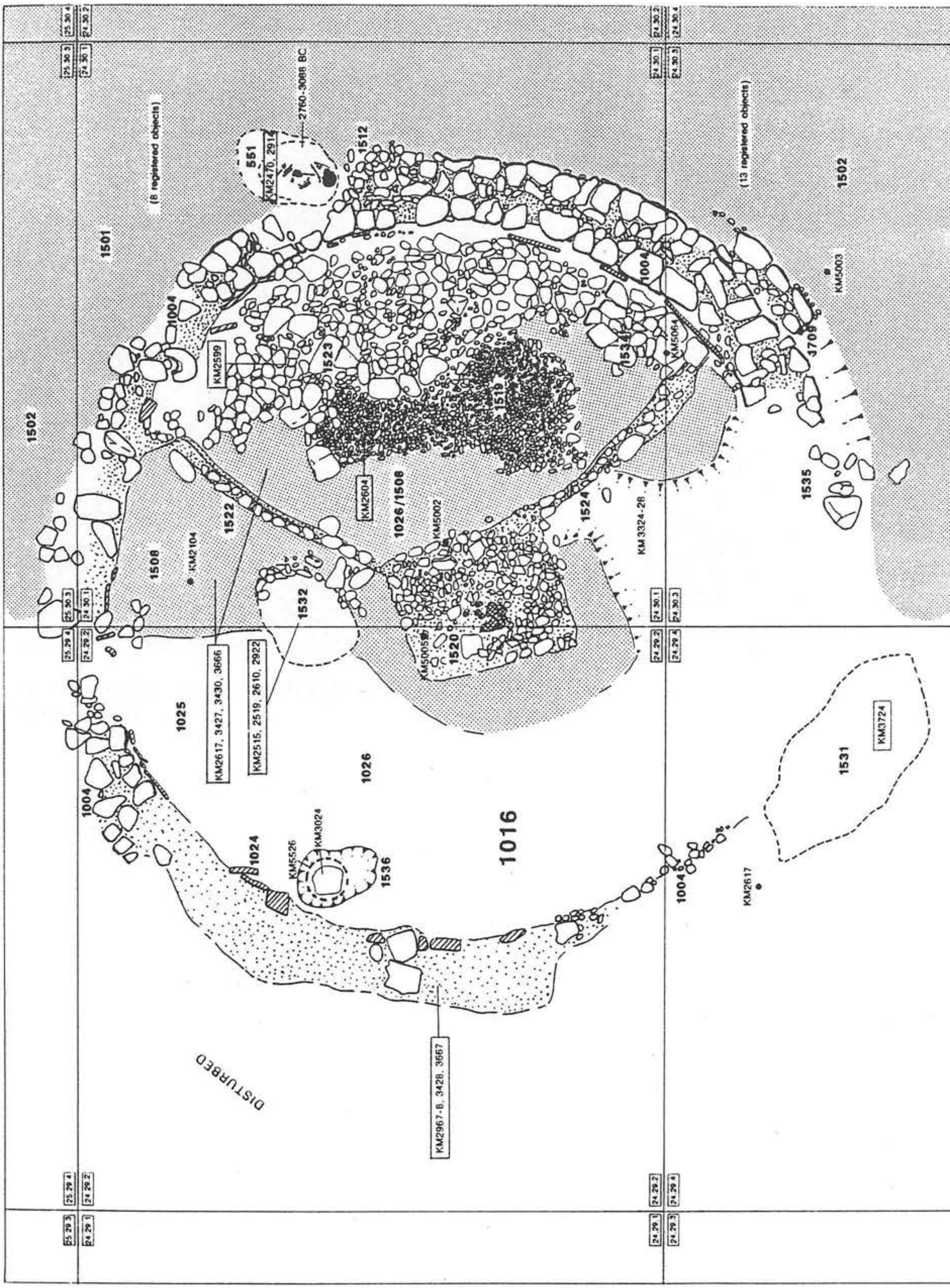


Fig 16 Kissonerga B1547, view from the E. Note the quality mud floor and ridges and the mudwall still in position on the stone footing at the bottom right.



Fgi. 17. Plan of Kissonerga B1016.

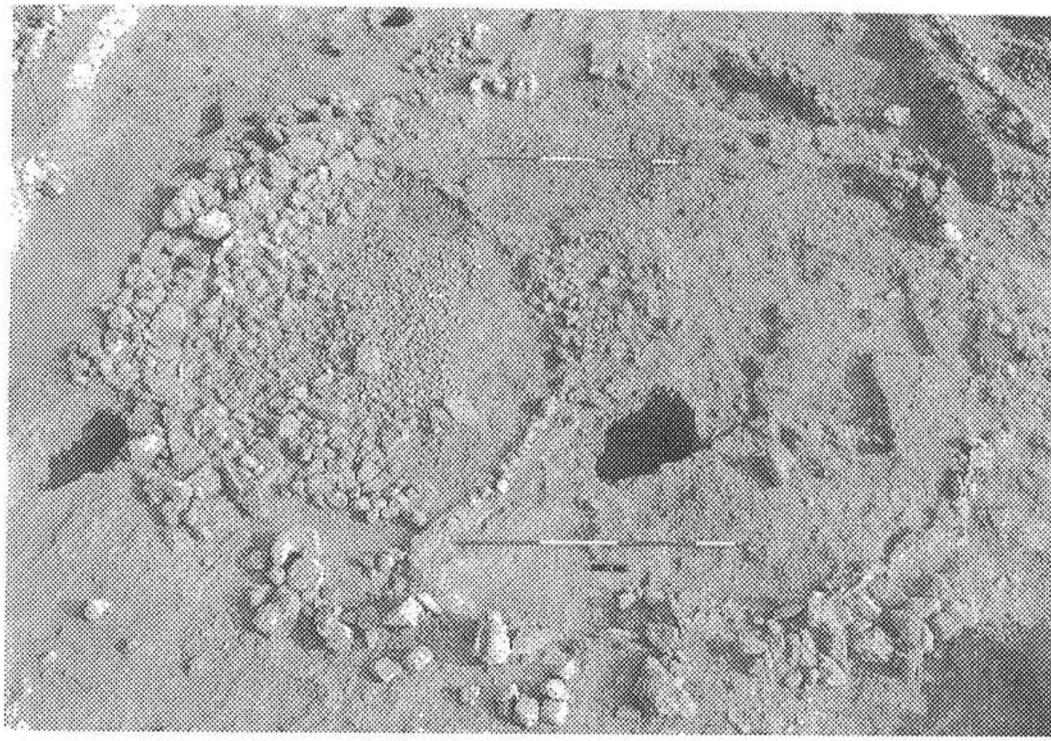


Fig. 18 Kissonerga B1016, view from the N. Note the cobbled surface, ridges and slabs along the base of the wall.

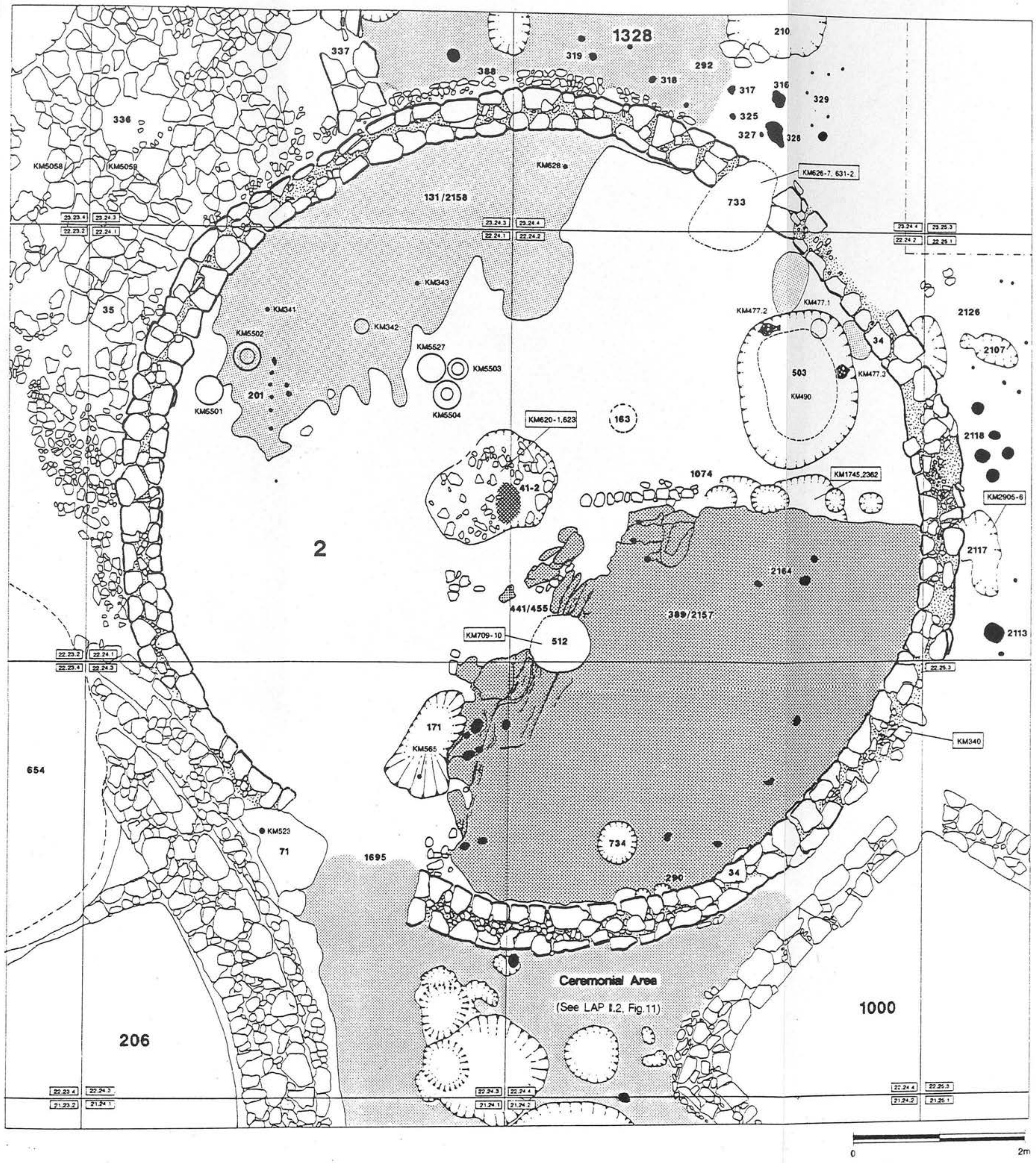


Fig. 19. Plan of Kissonerga B2.

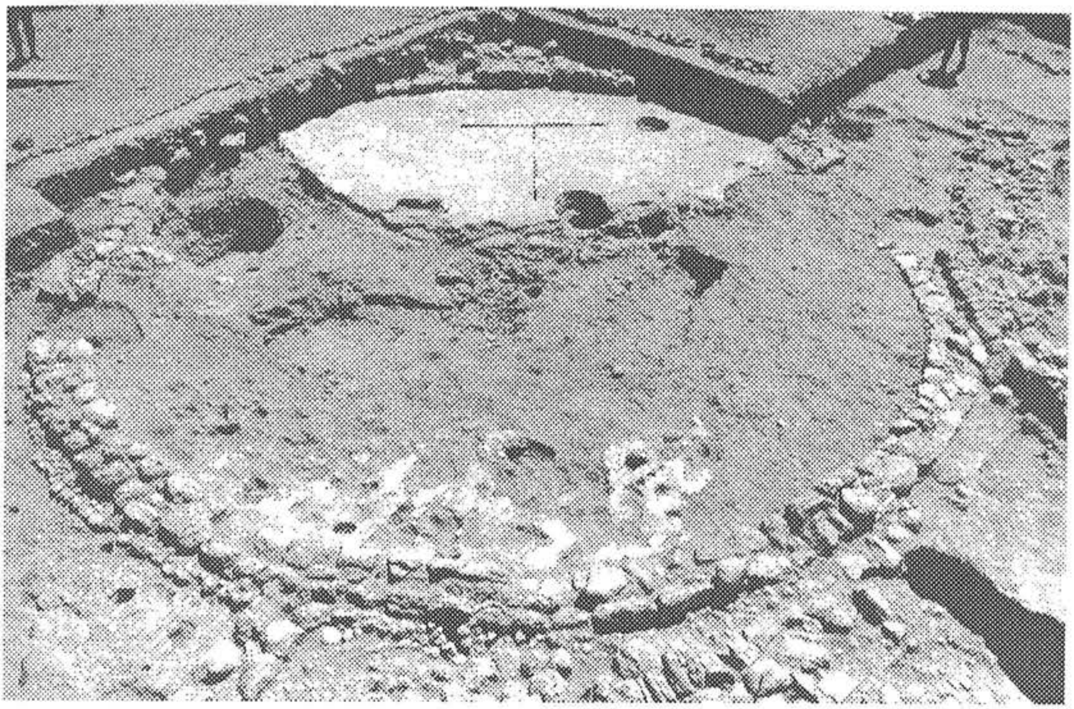


Fig. 20 Kissonerga B2, view from the NW with the large plaster floor at the rear of the photograph and the entrance to the right. Note the stone packing at the base of the wall exterior.

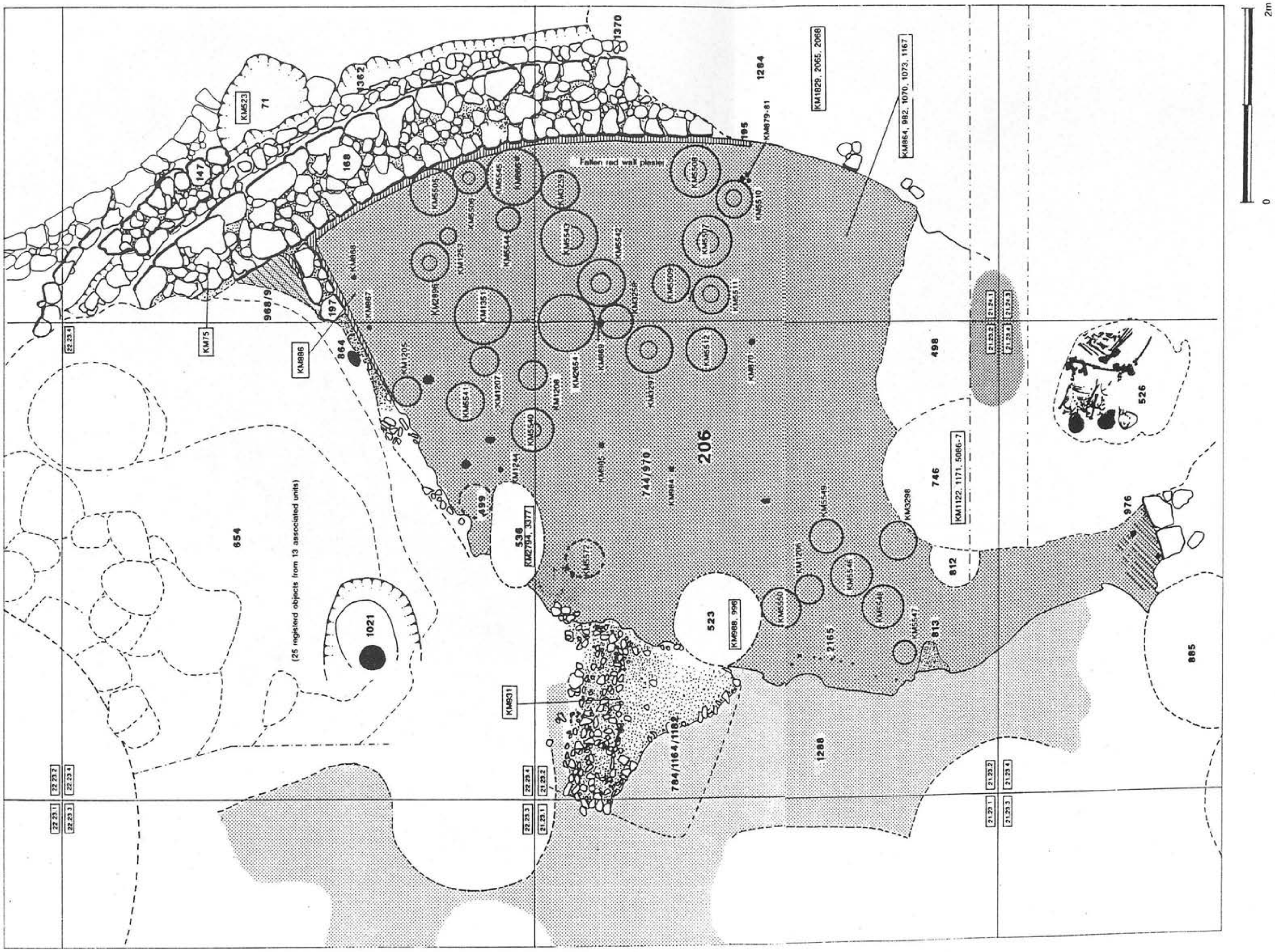


Fig. 21. Plan of Kissonerga B206.

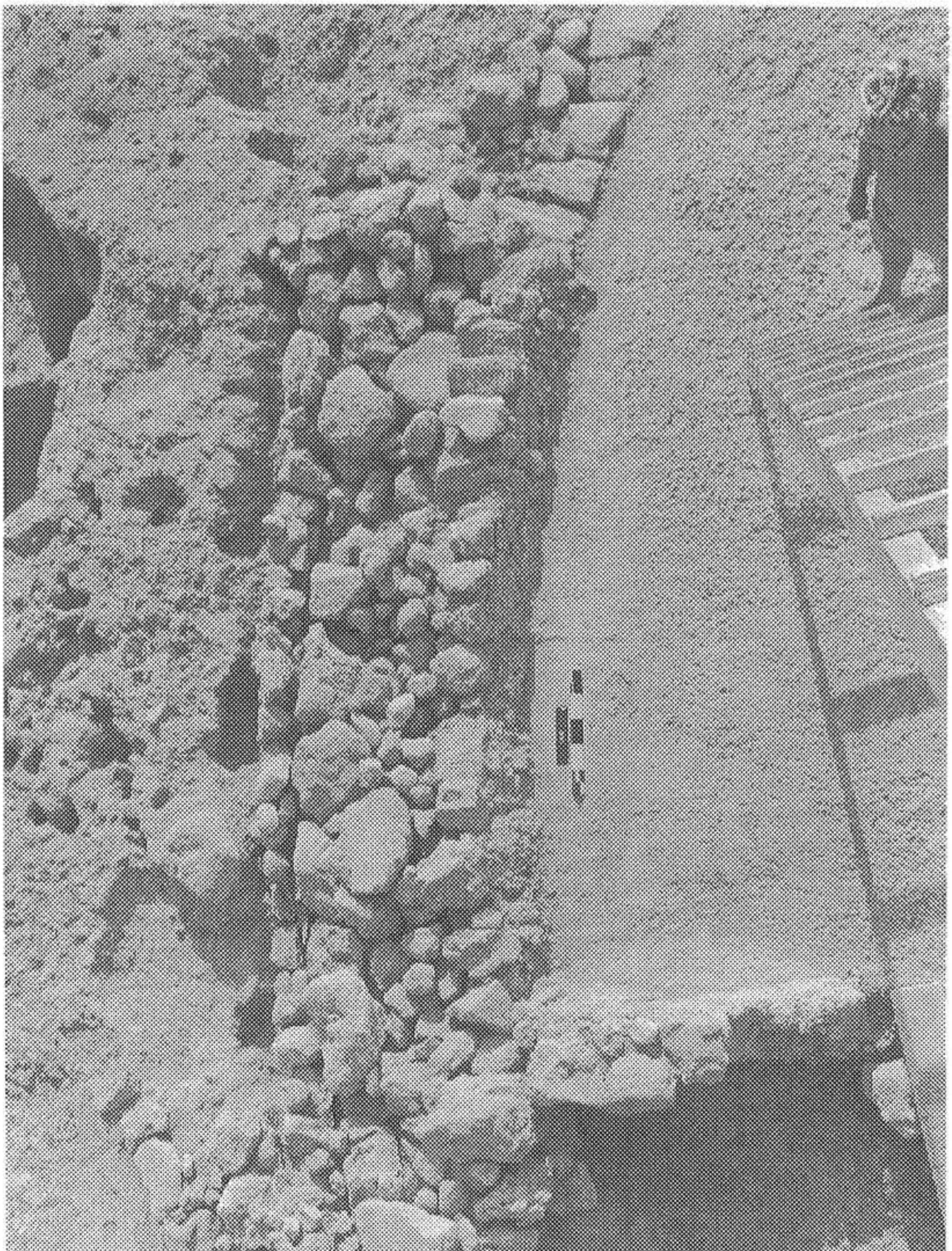


Fig 22 Kissonerga B206, view looking down on to the top of the wall, floor and radial division. The wall plaster and exterior stone packing can clearly be seen.

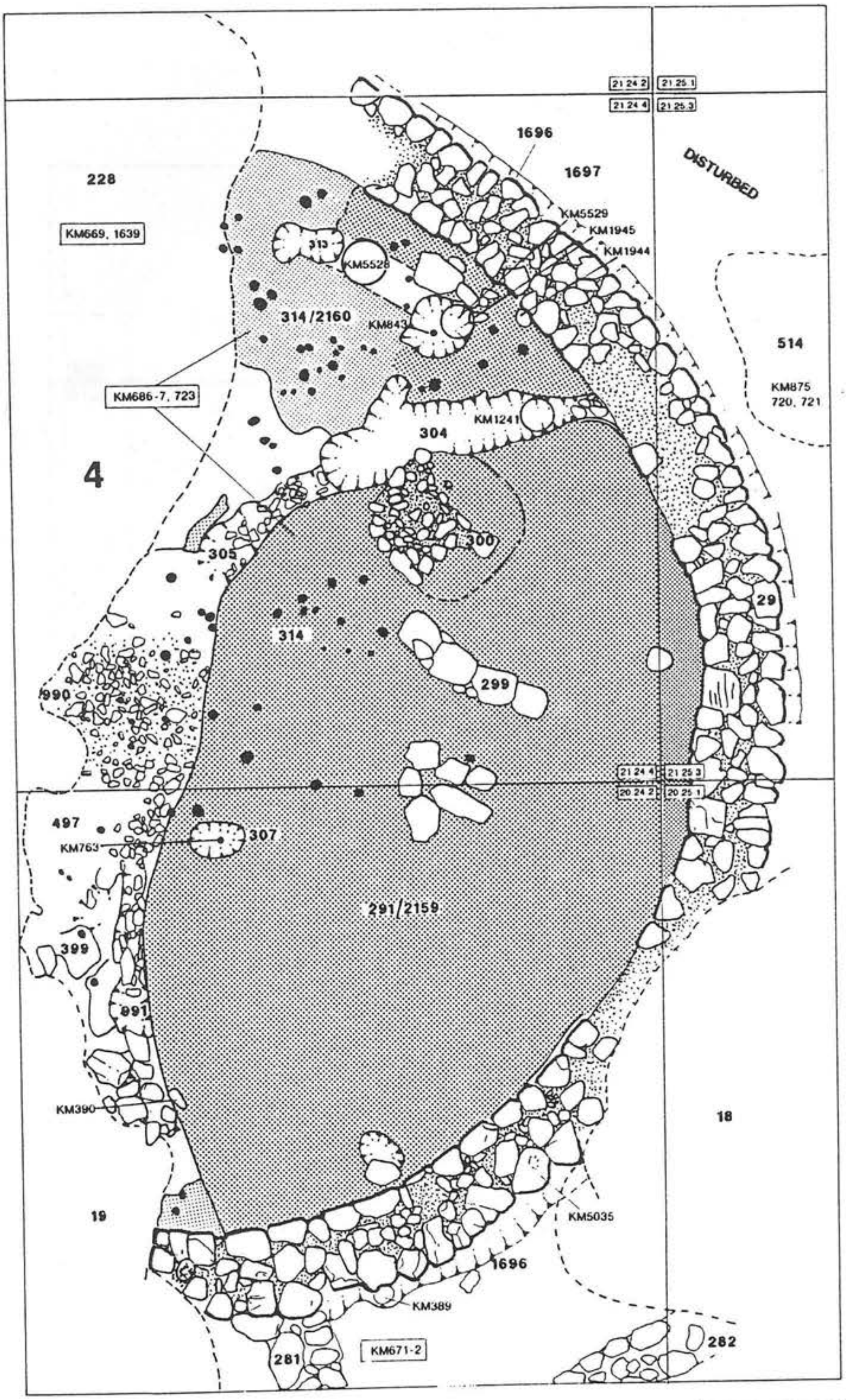


Fig. 23. Plan of Kissonerga B4.

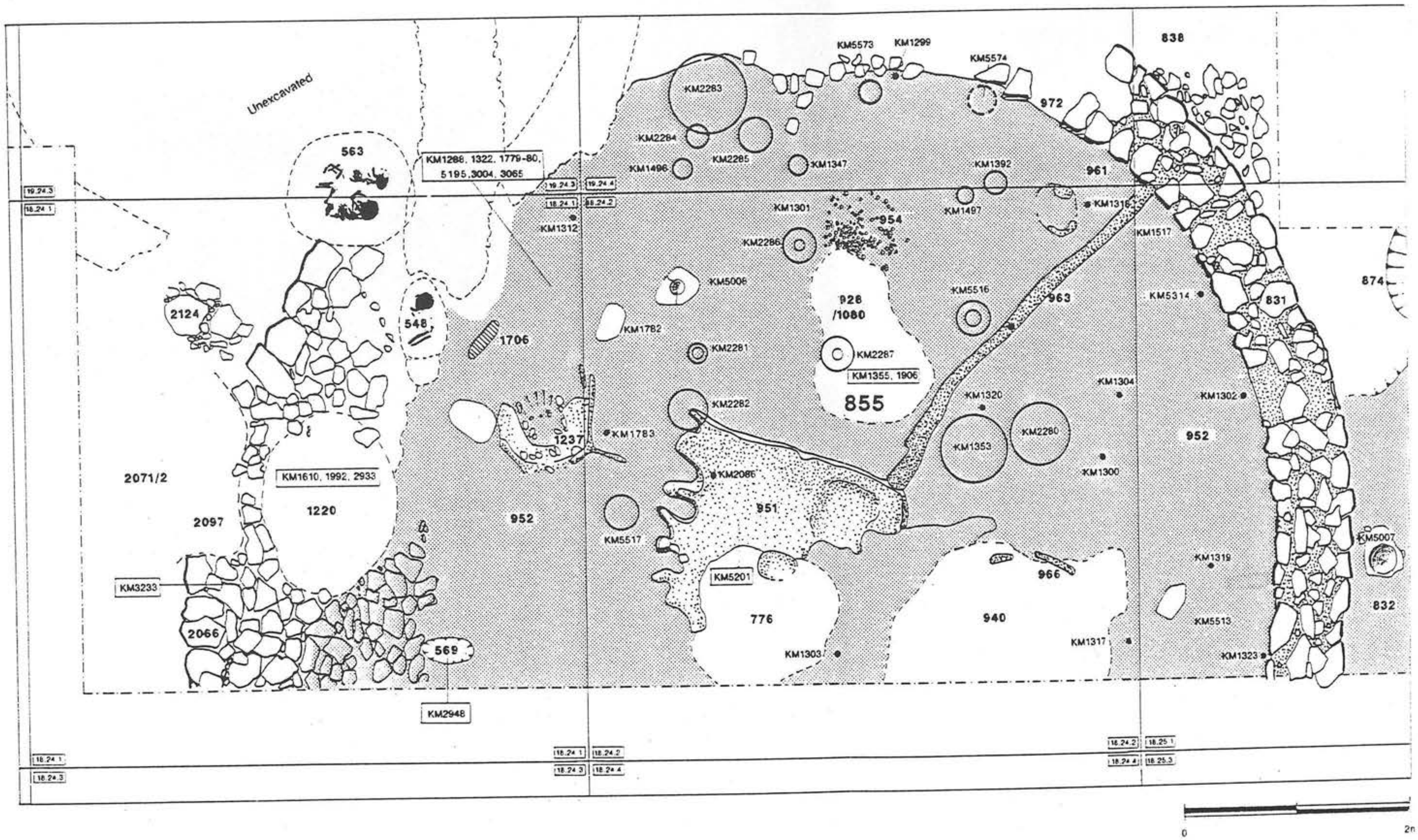


Fig. 24. Plan of Kissonerga B855.

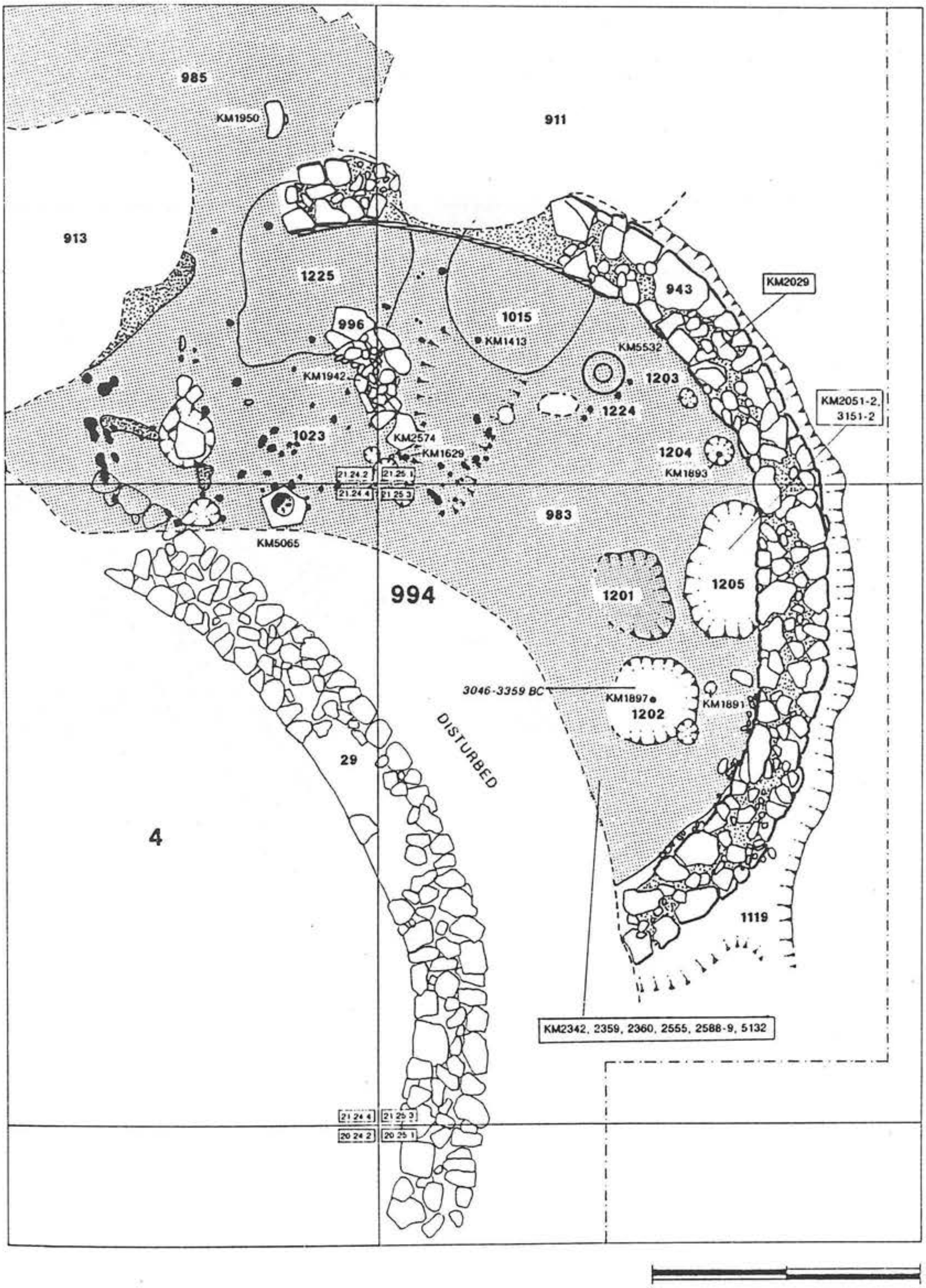


Fig. 25. Plan of Kissonerga B994.

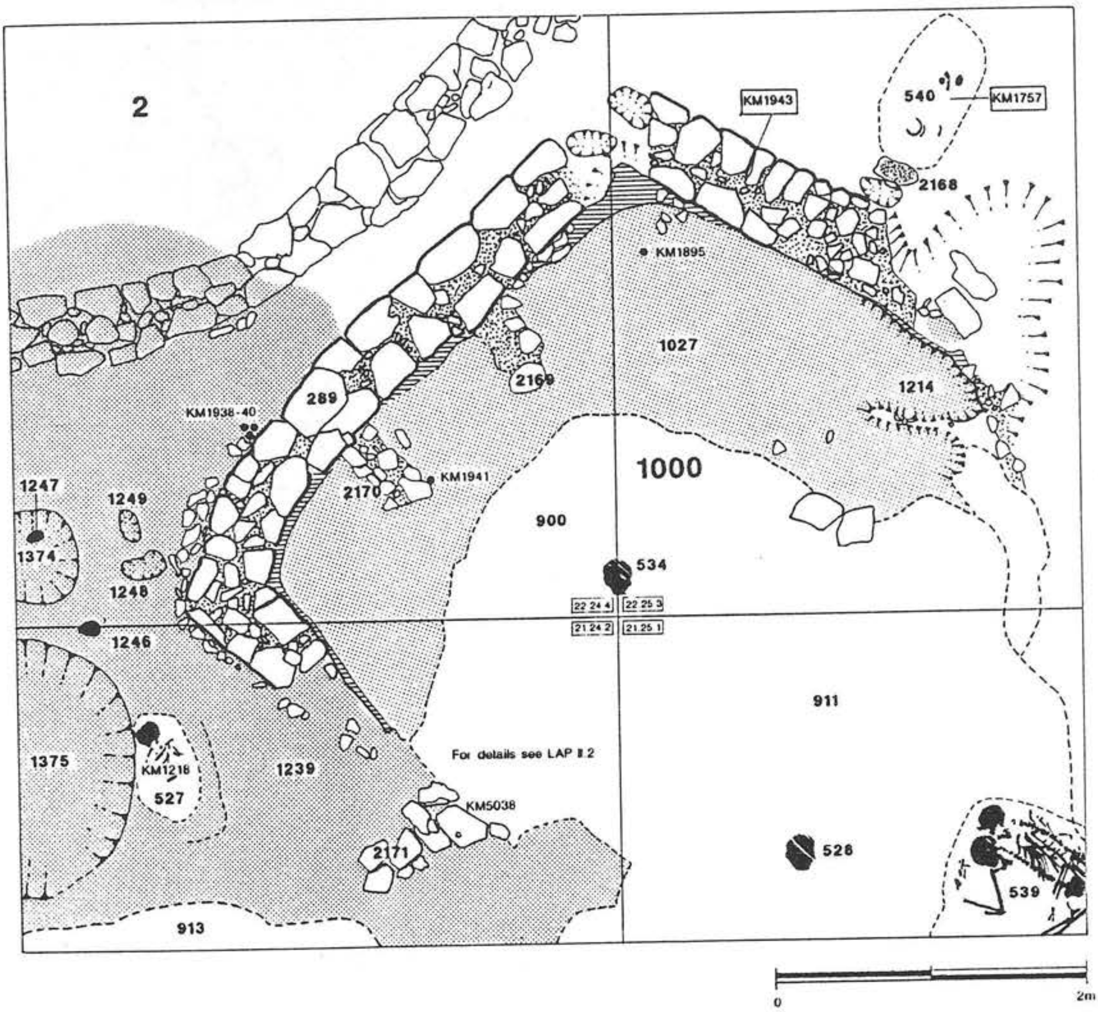


Fig. 26. Plan of Kissonerga B1000.

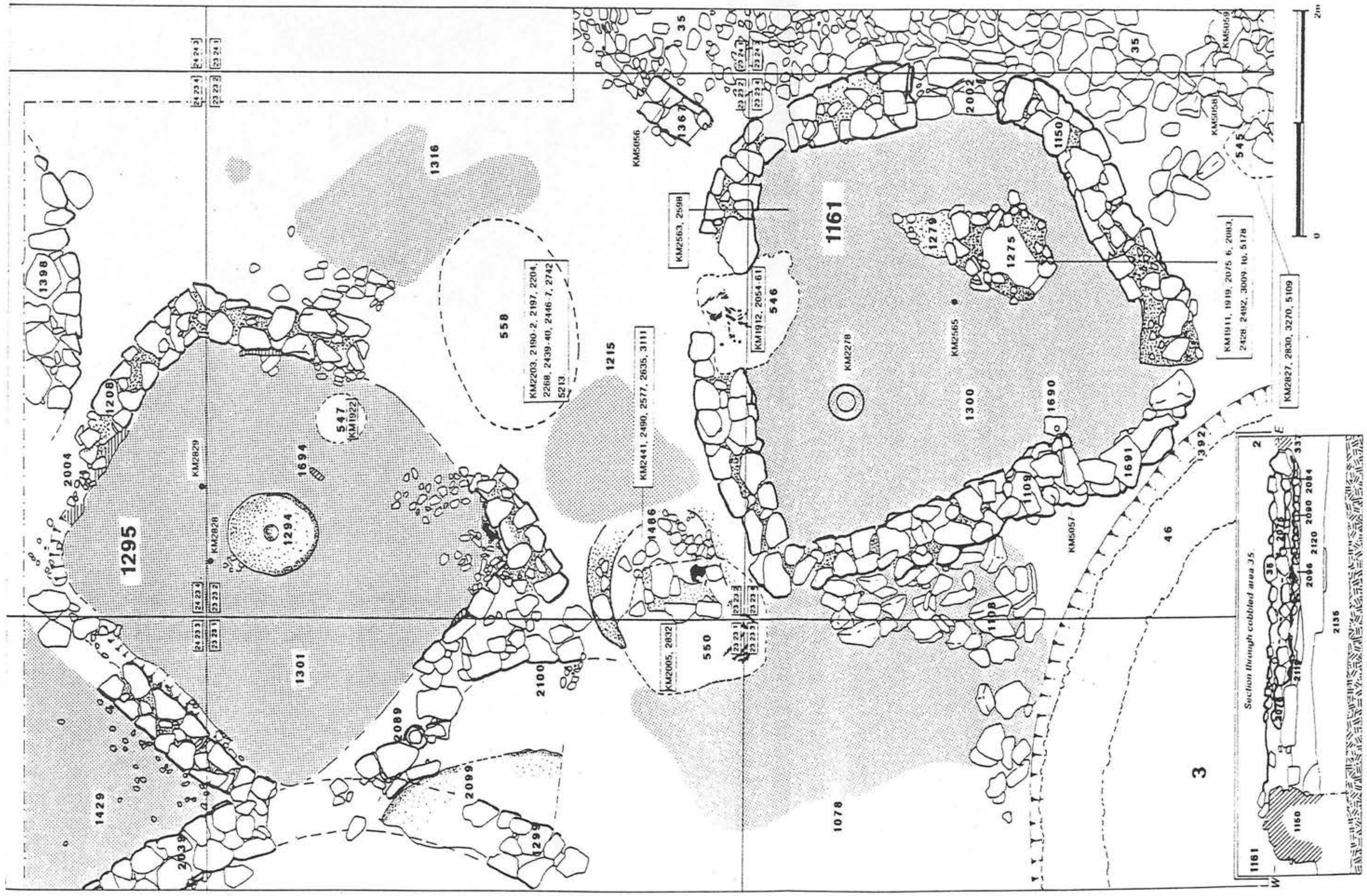


Fig. 27. Plan of Kissonerga B1161 and B1295.

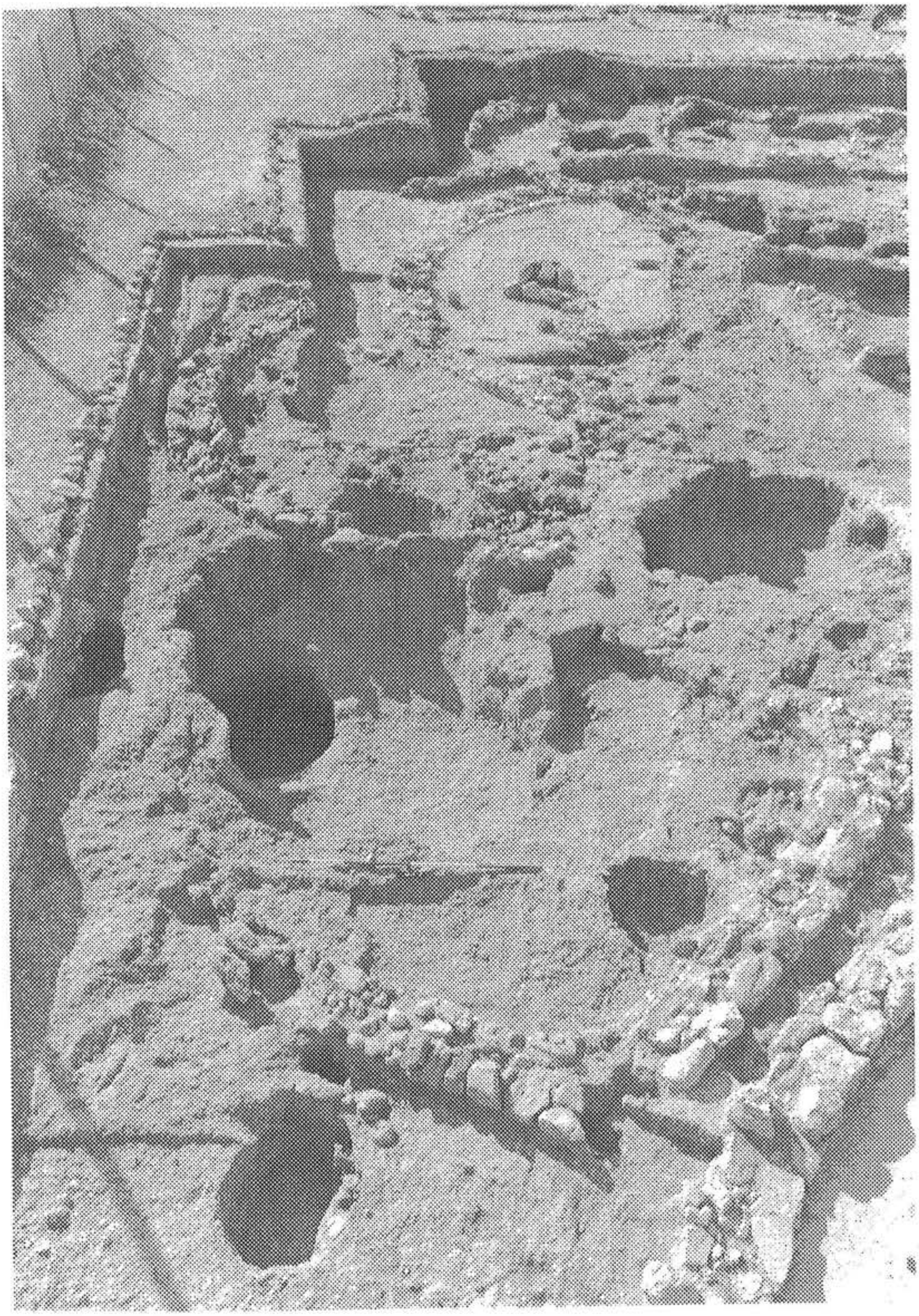


Fig. 28 Kissonerga B1000, view looking from the N over to B994 and B4 in the background.

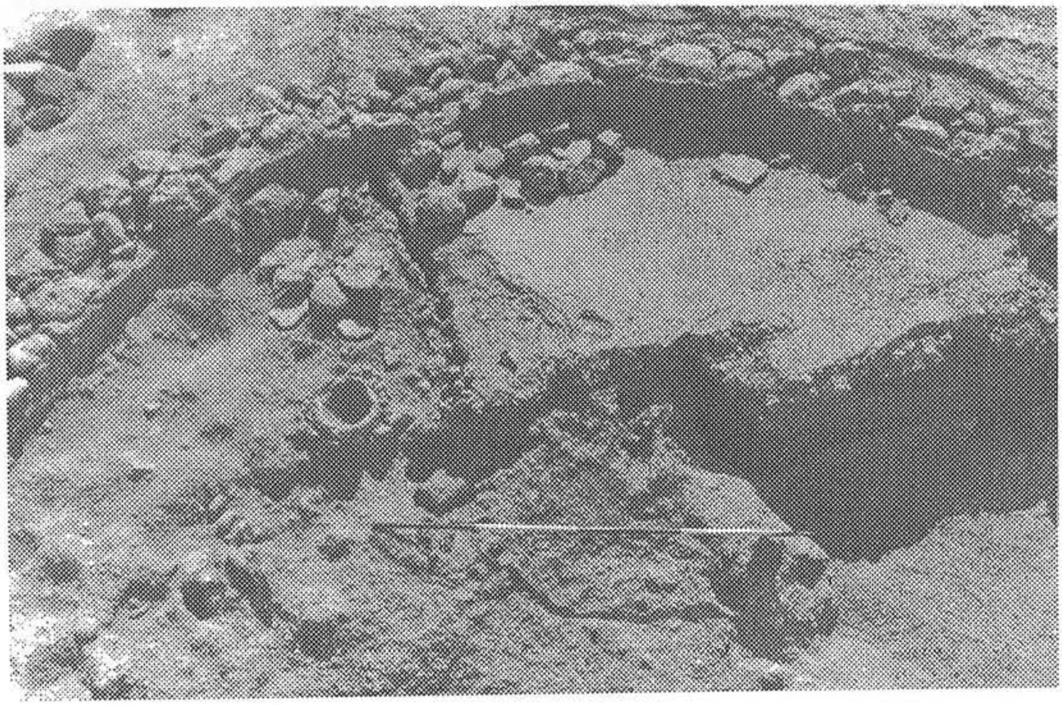


Fig. 29 Lemba B1 view from the W.

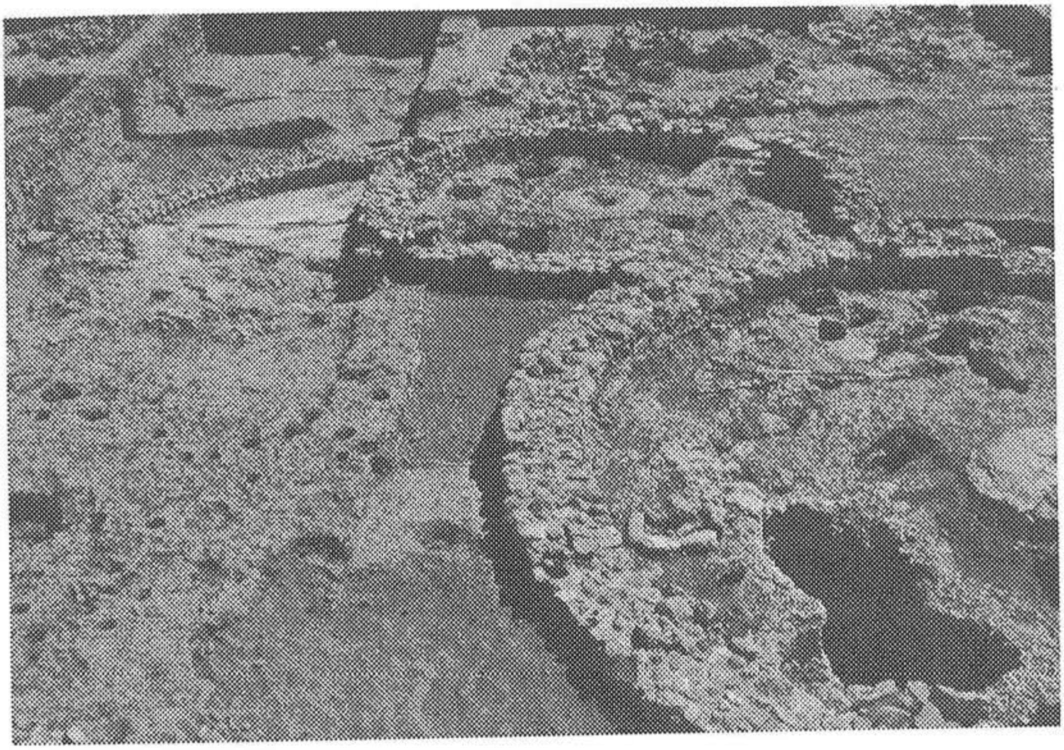


Fig. 30 Lemba Area II view overlooking B2 to the right with B3 and B7 beyond. B4 lies beneath B3 to the left.

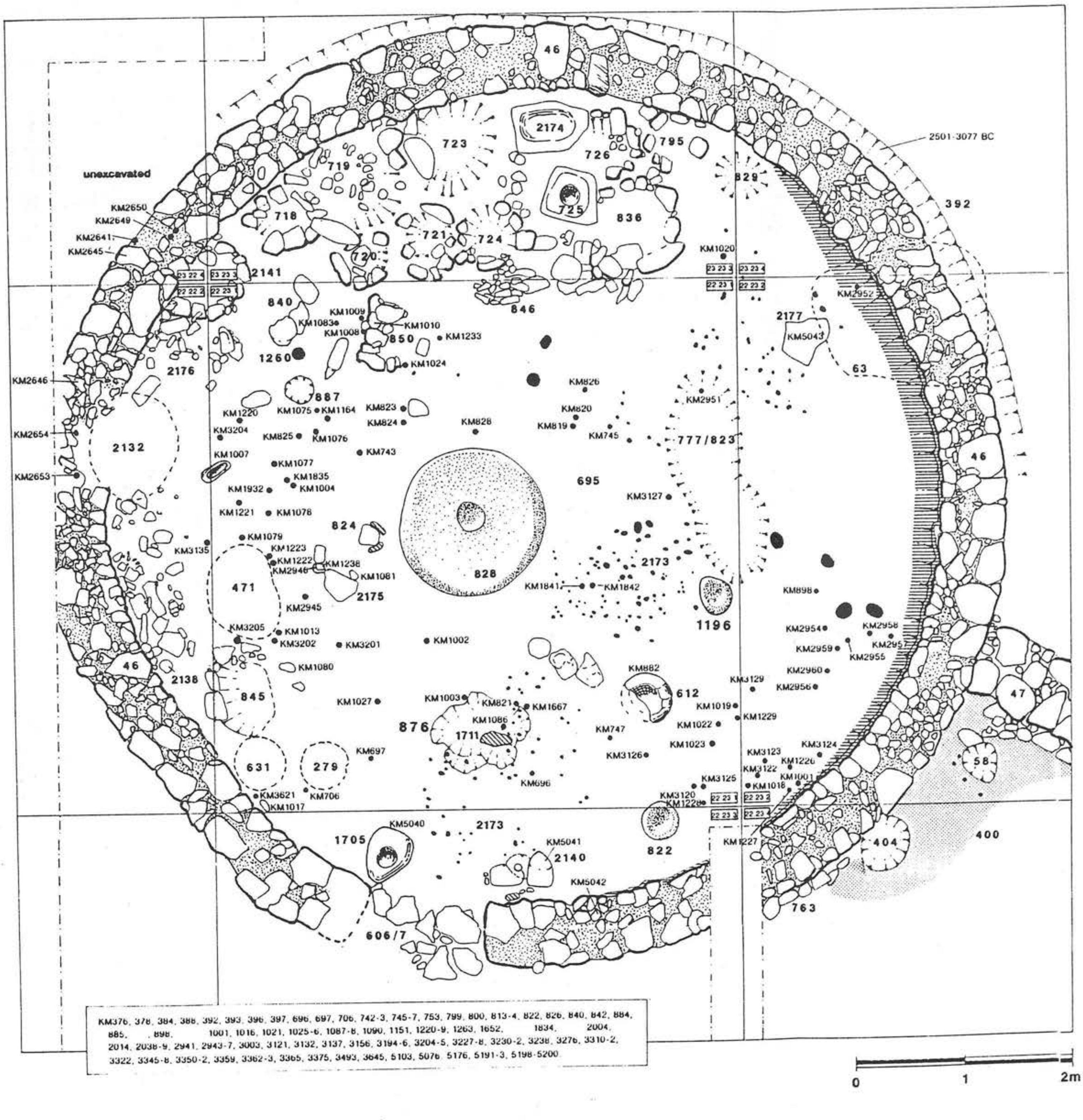


Fig. 31. Plan of Kissonerga B3.

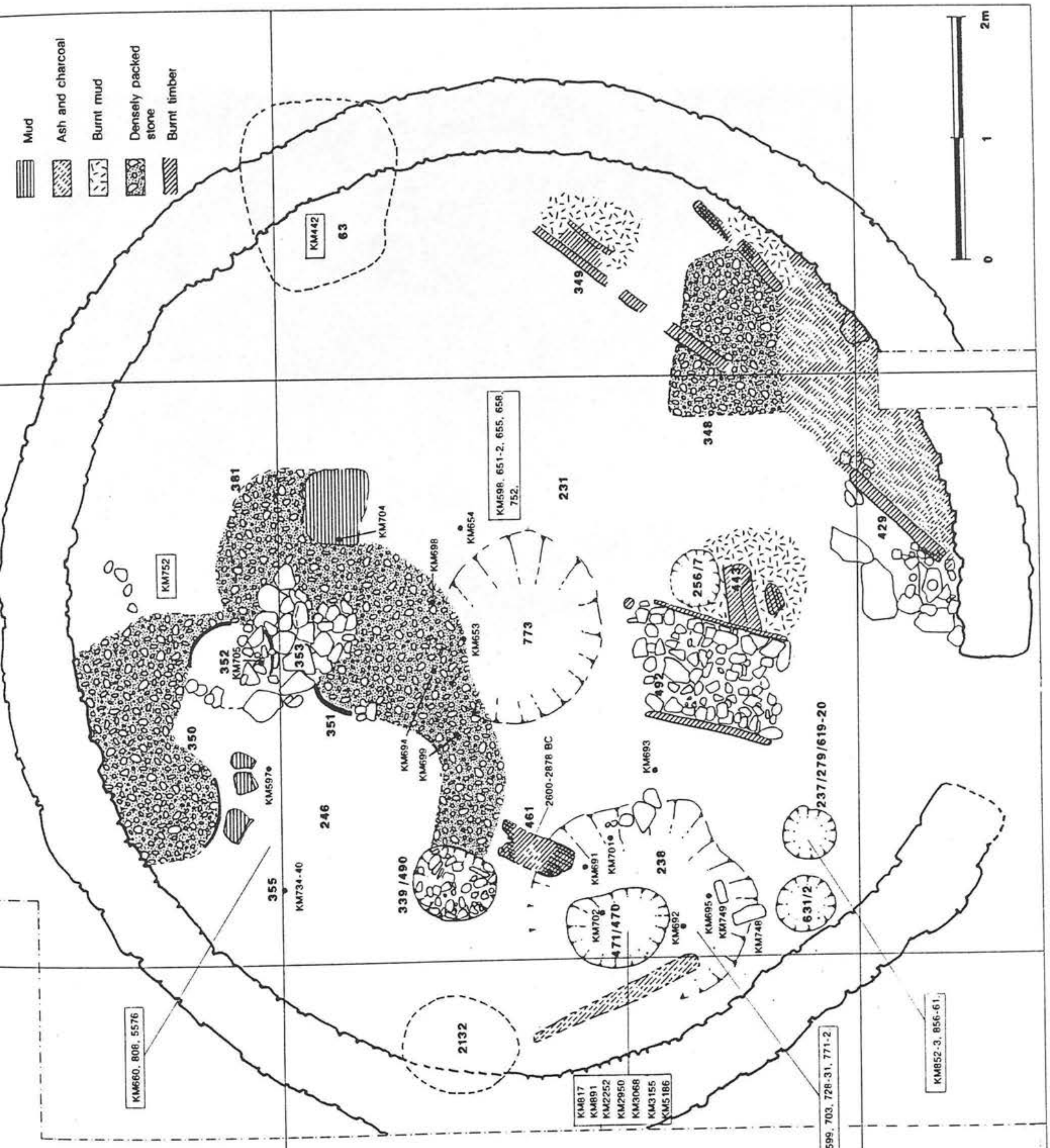


Fig. 32. Plan of the destruction within B3 showing the collapsed and burnt material.

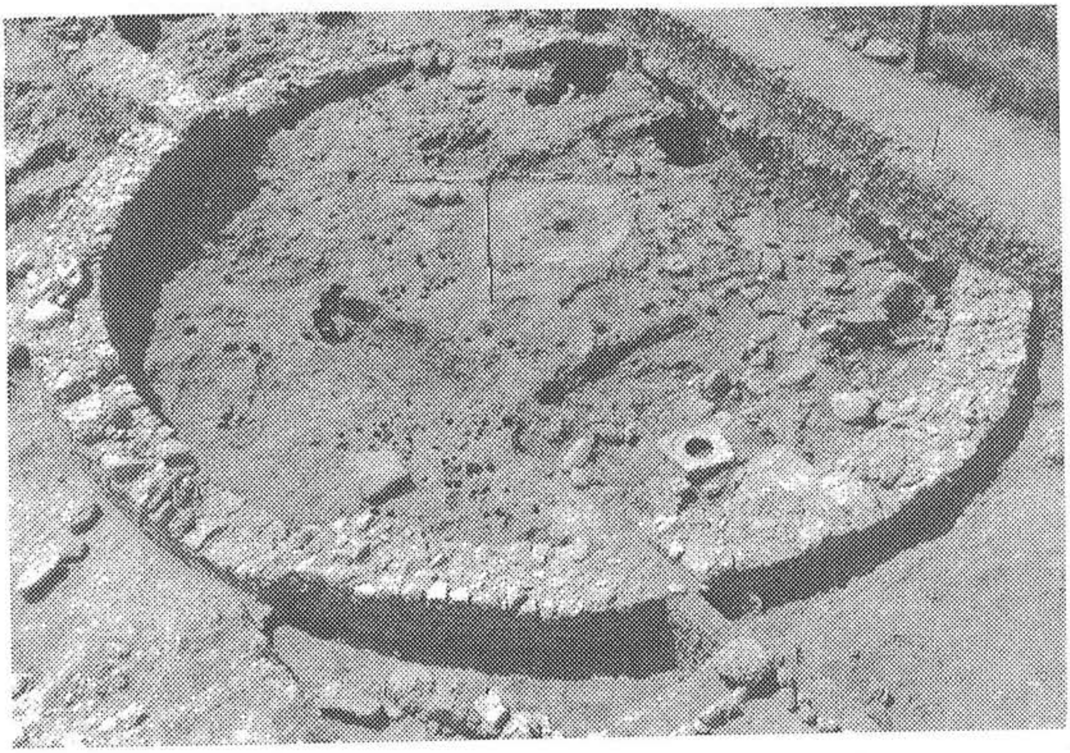


Fig. 33 Kissonerga B3, view from the N showing the fixtures on the floor of the building with the hearth beside the ranging rods and the entrance beyond.

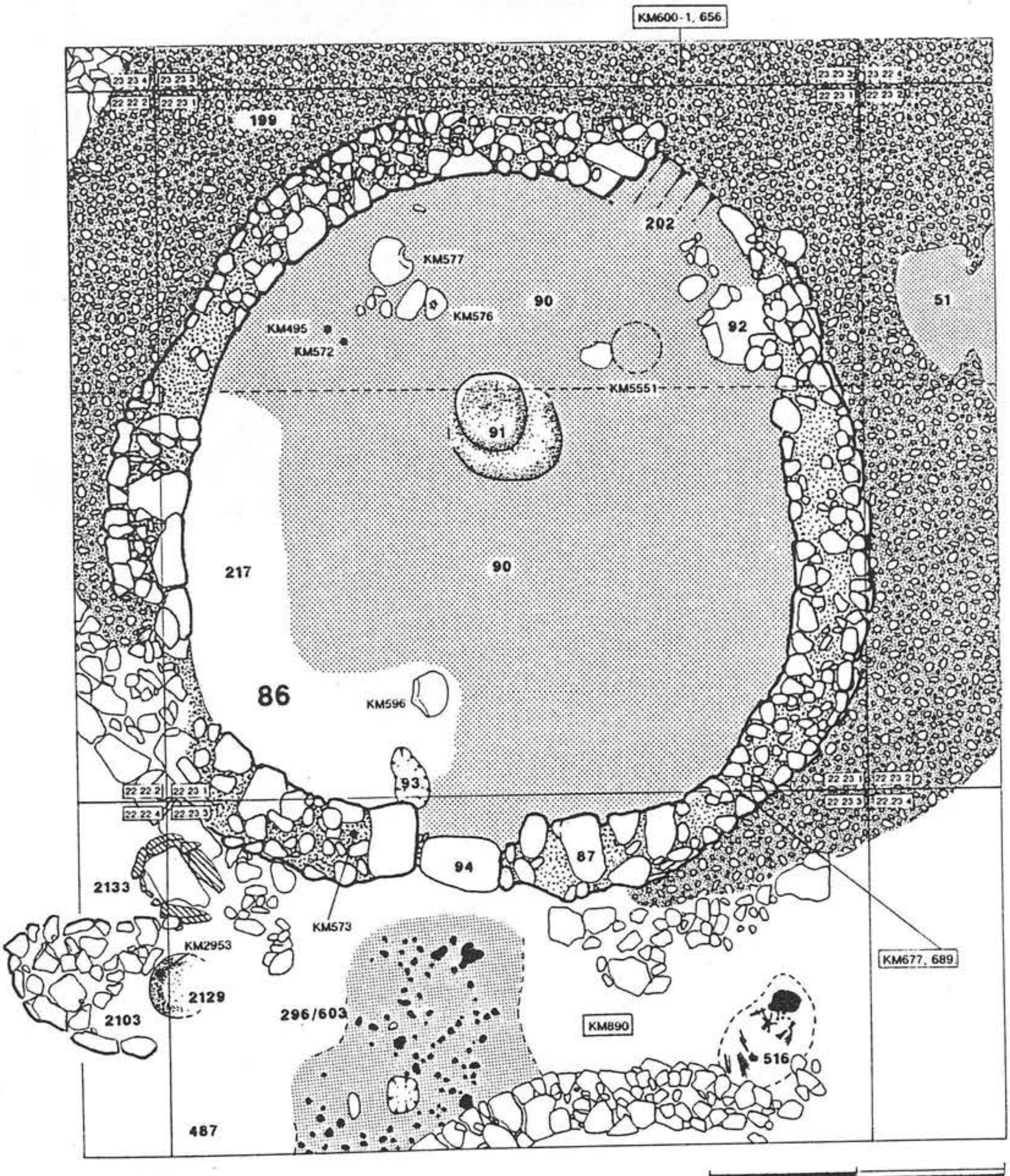


Fig. 34. Plan of Kissonerga B86.

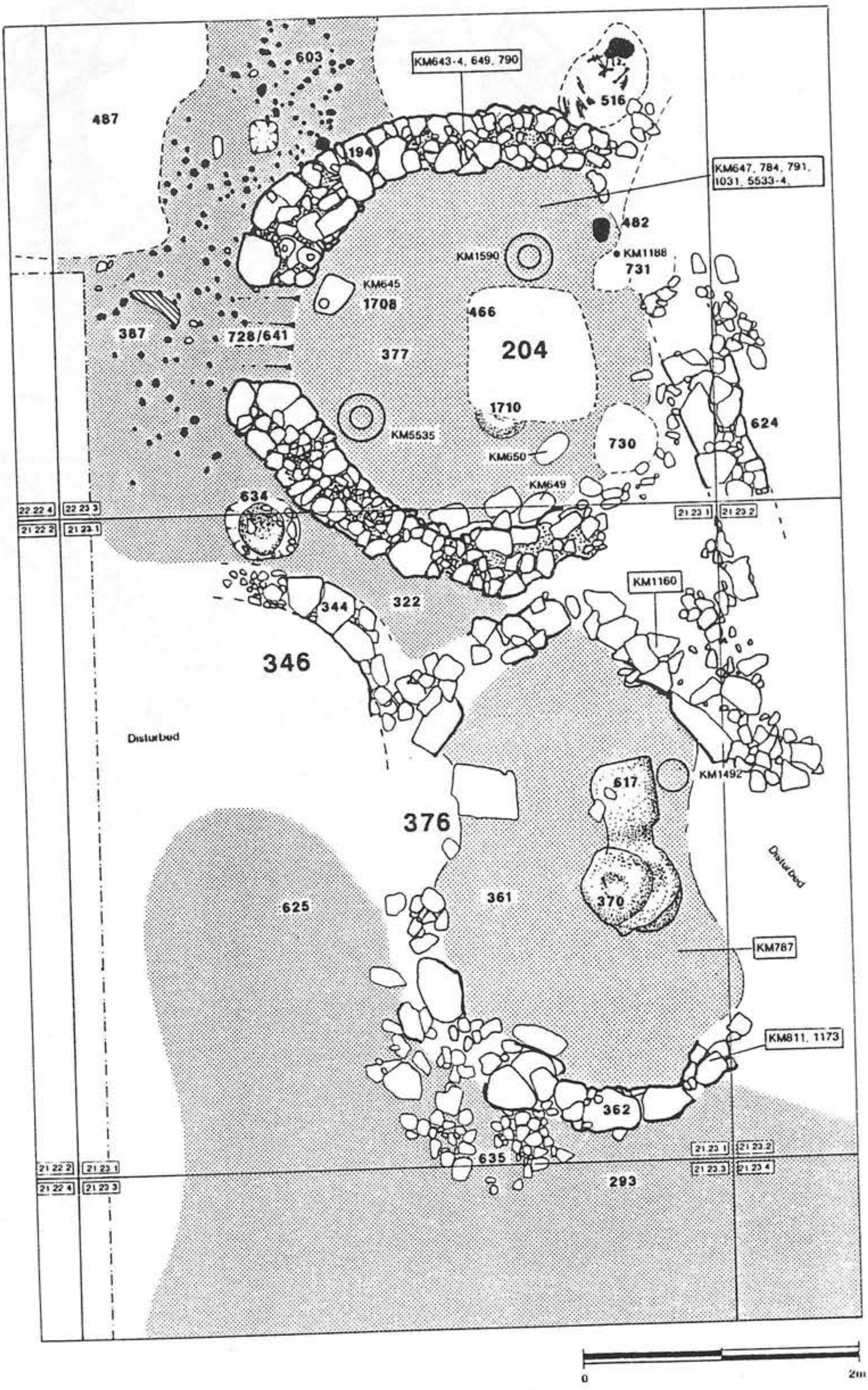


Fig. 35. Plan of Kissonerga B204 and B376.

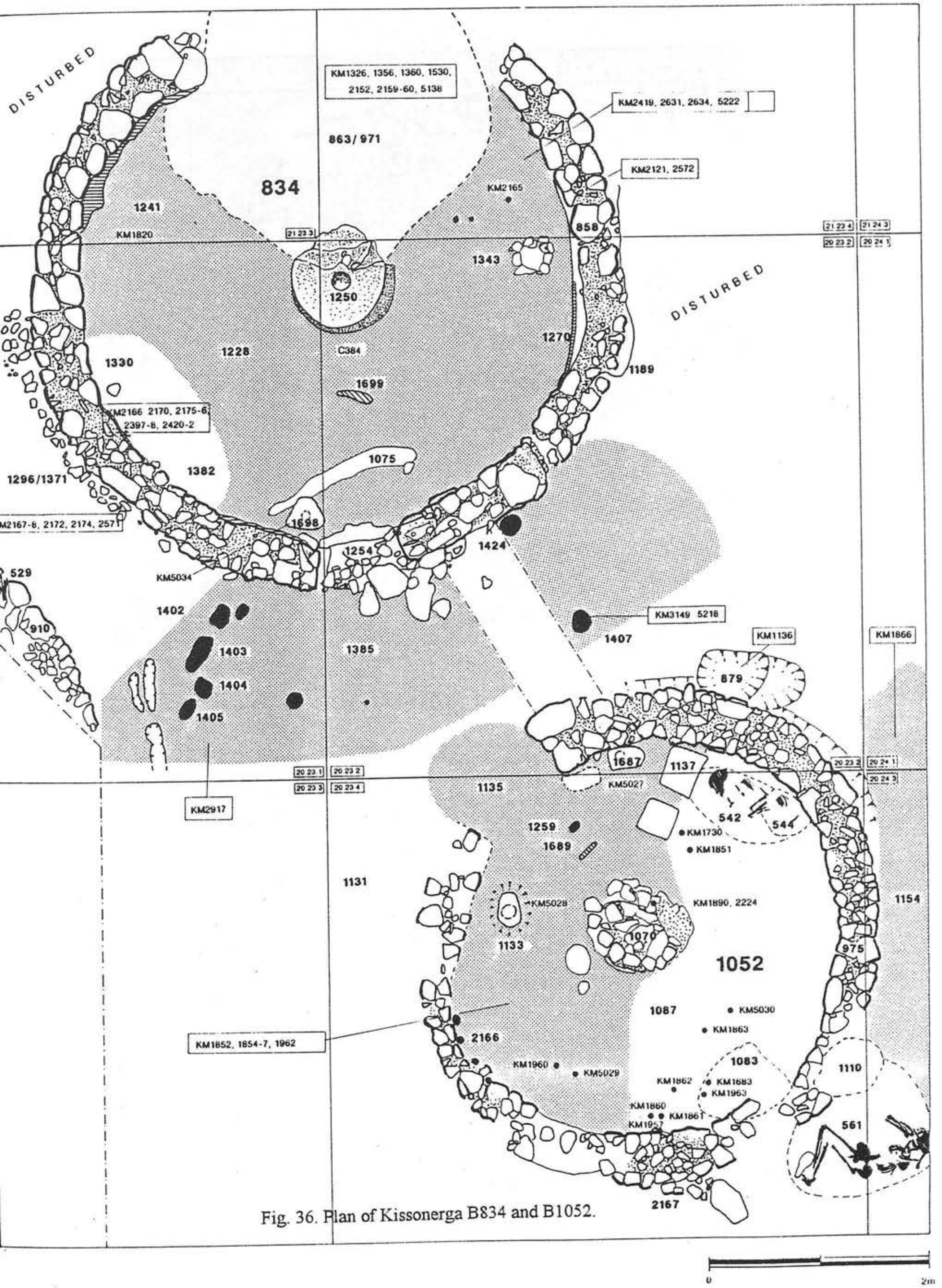


Fig. 36. Plan of Kissonerga B834 and B1052.

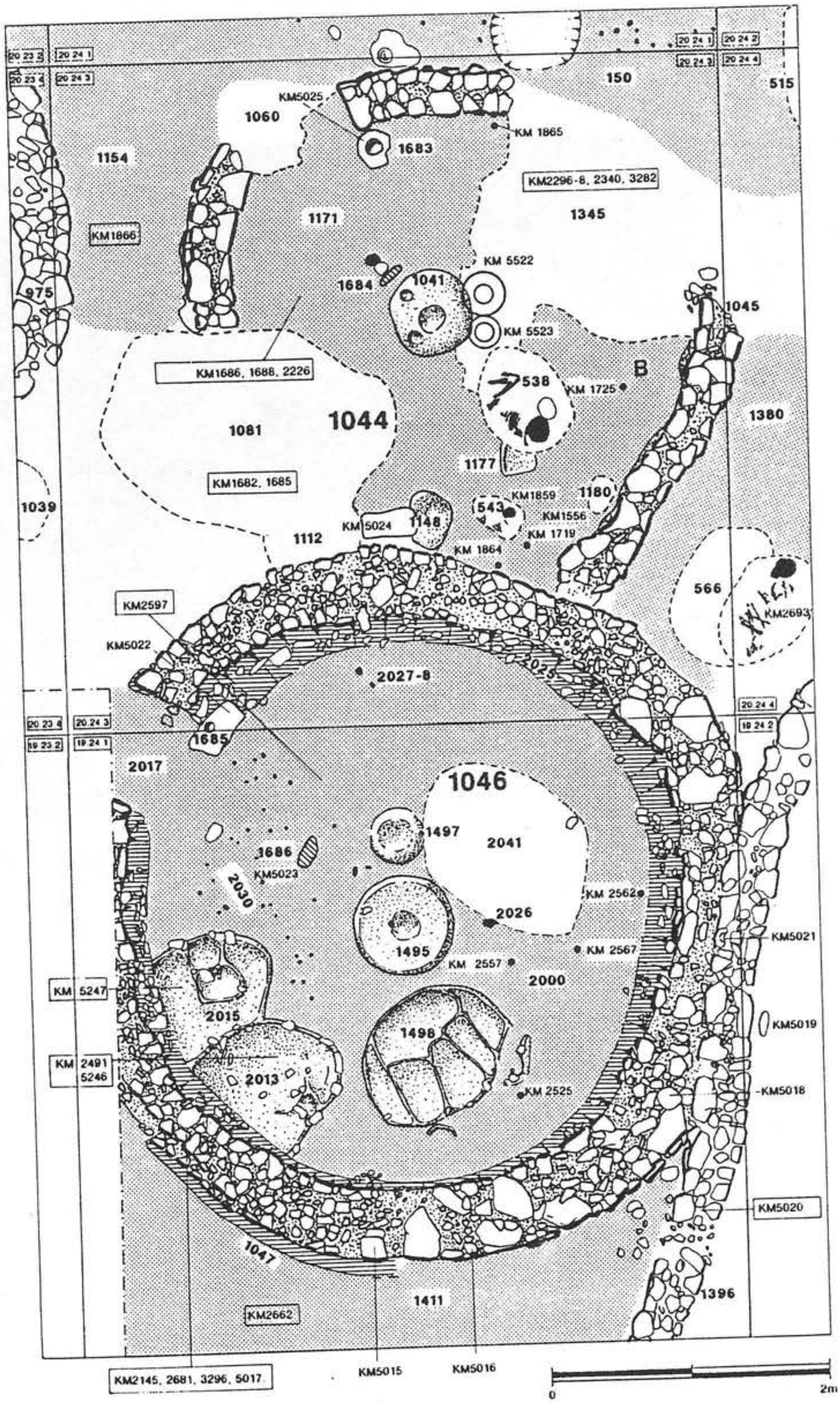


Fig. 37. Plan of Kissonerga B1044 and B1046.

Fig. 38 Kissonerga B1052 view from the W. The tanour is at the centre of the building.

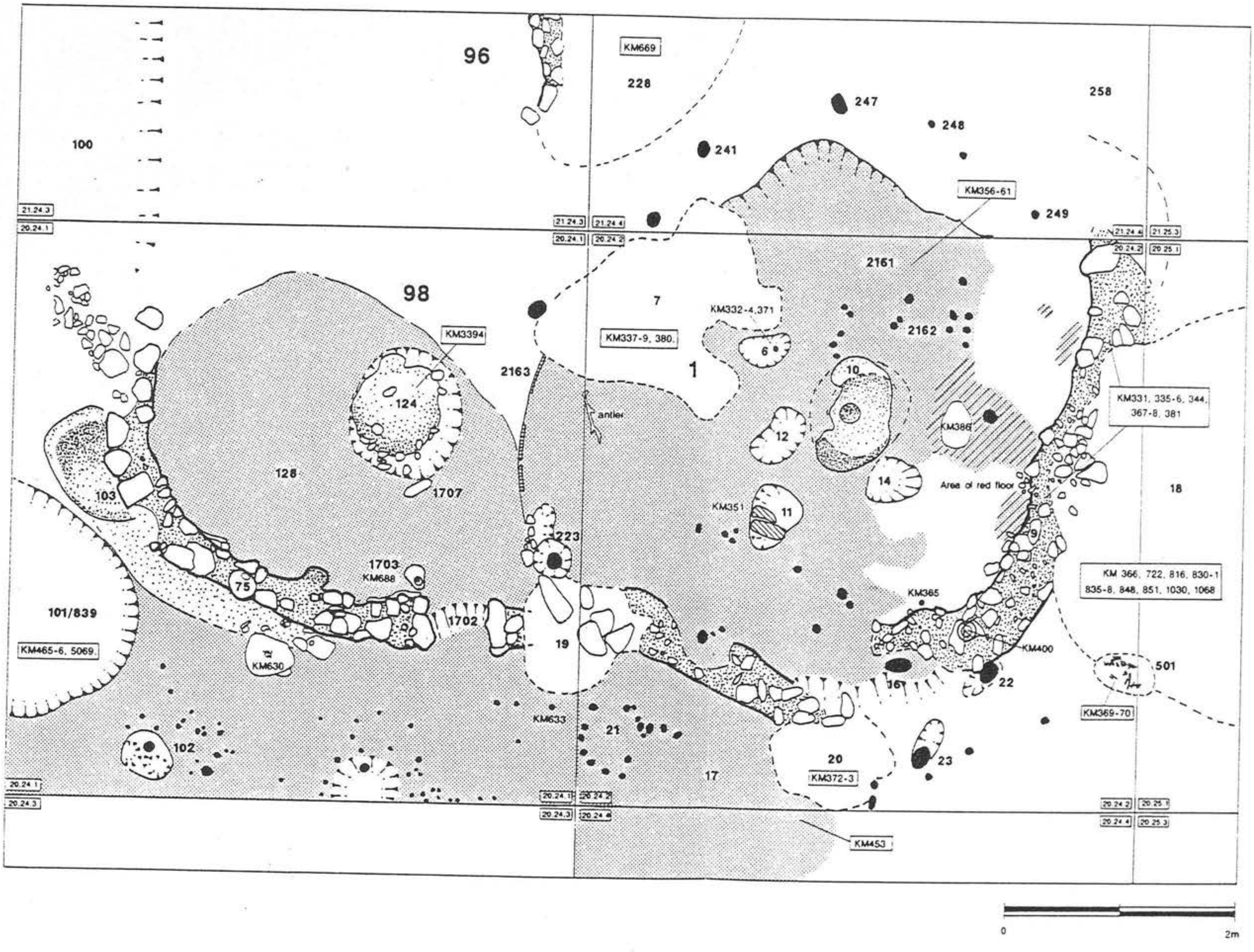


Fig. 39. Plan of Kissonerga B1 and B98.

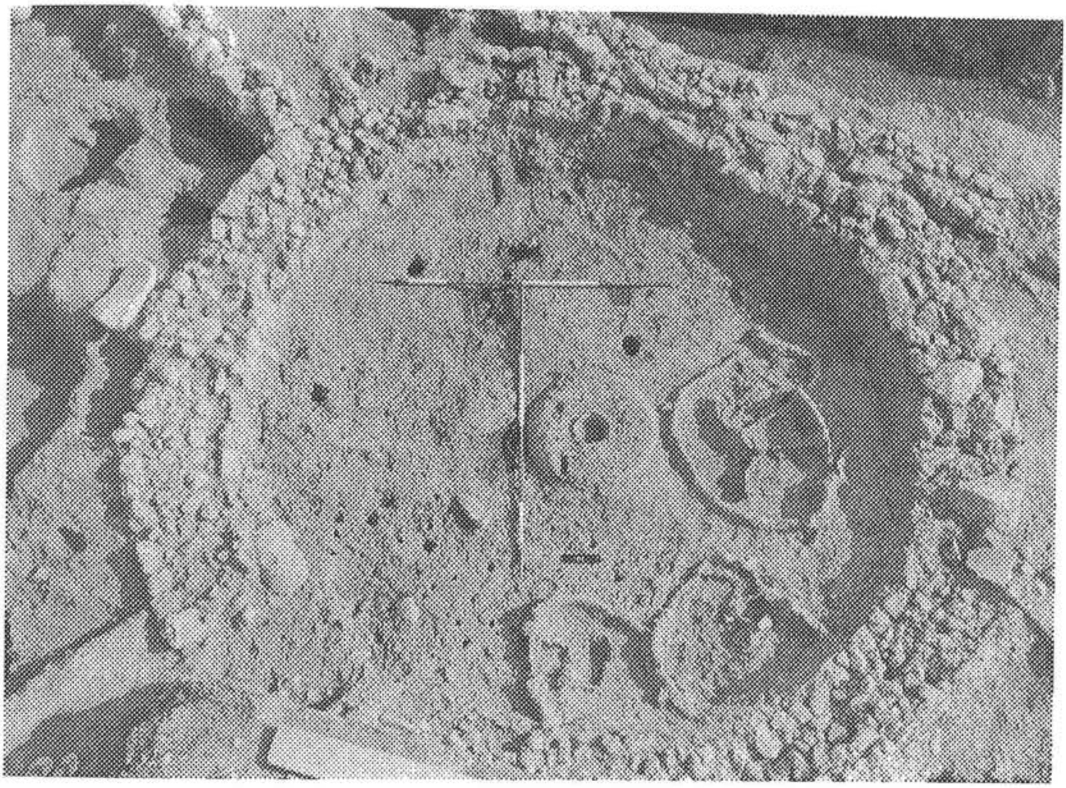


Fig. 40 Kissonerga B1046, view from the W.

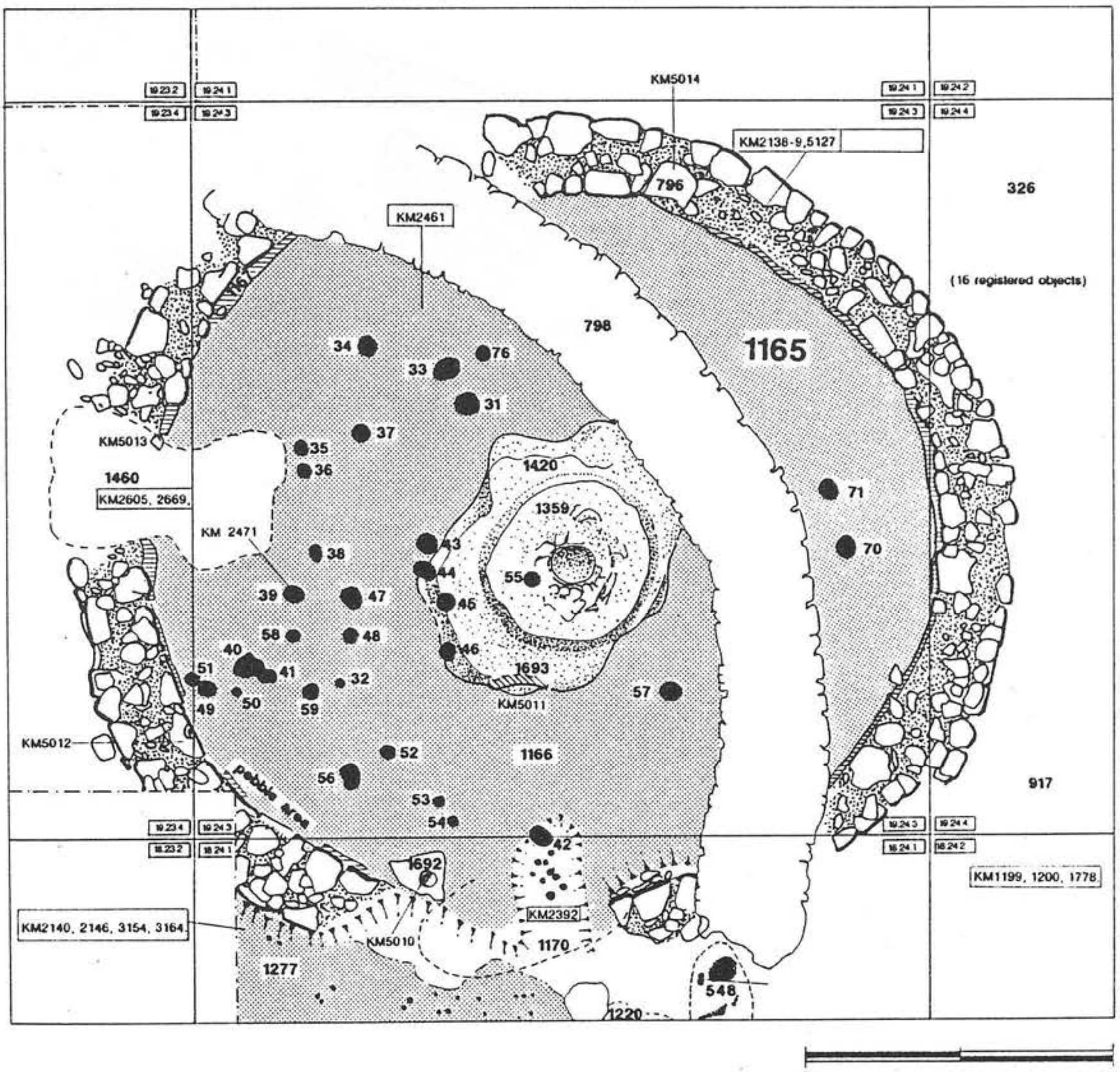


Fig. 41. Plan of Kissonerga B1165.

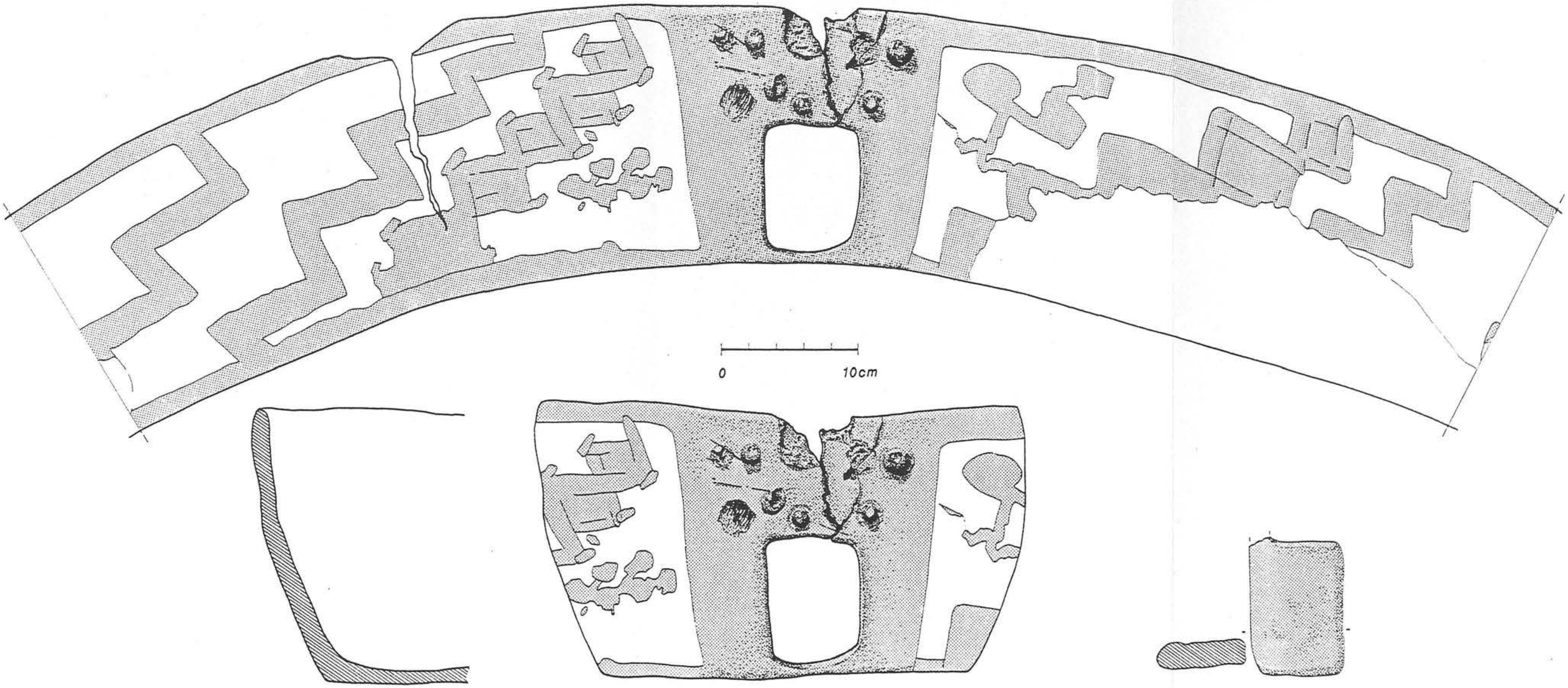


Fig. 42. Building model KM1446, exterior.

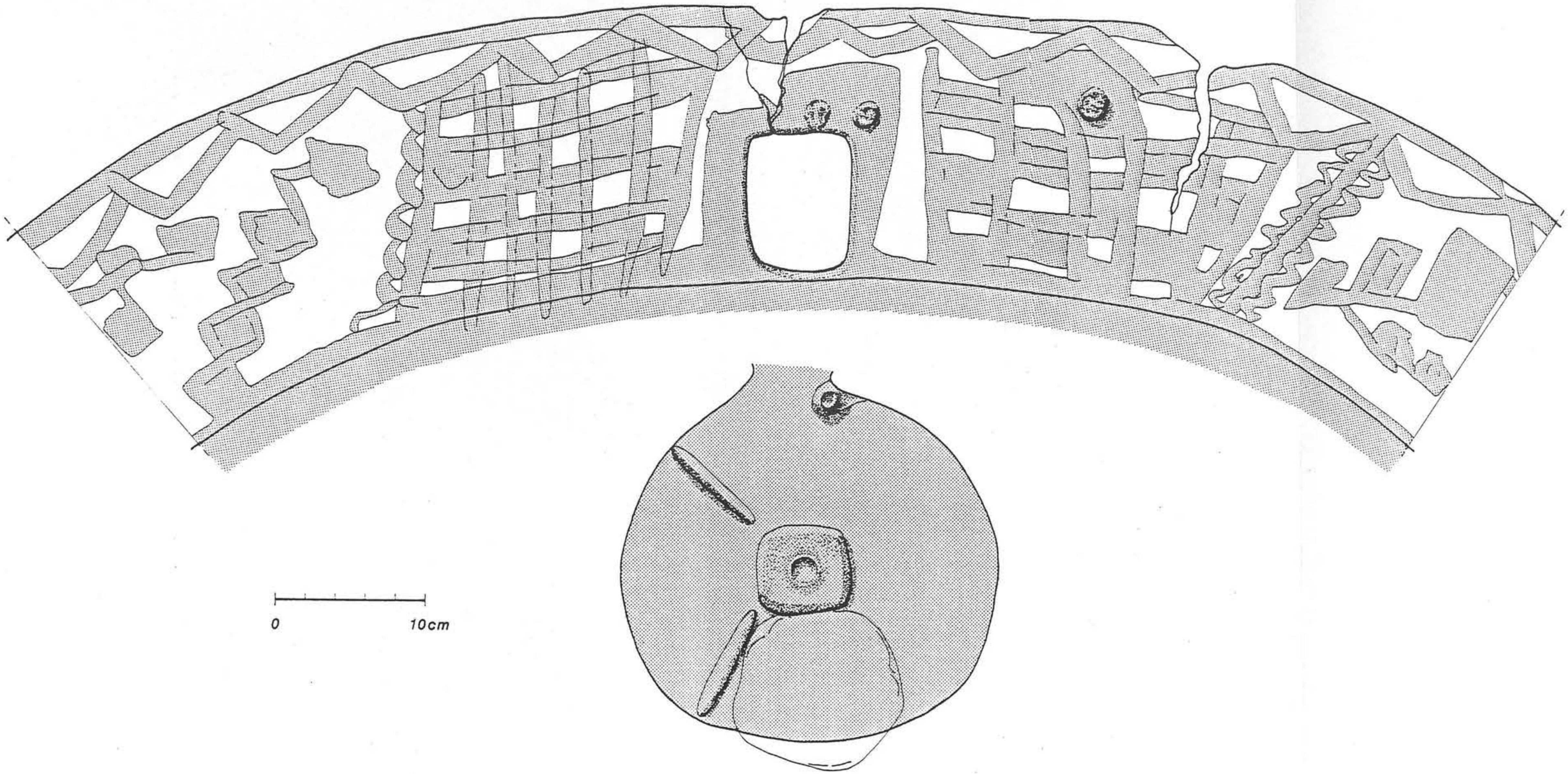


Fig. 43. Building model KM1446, interior.

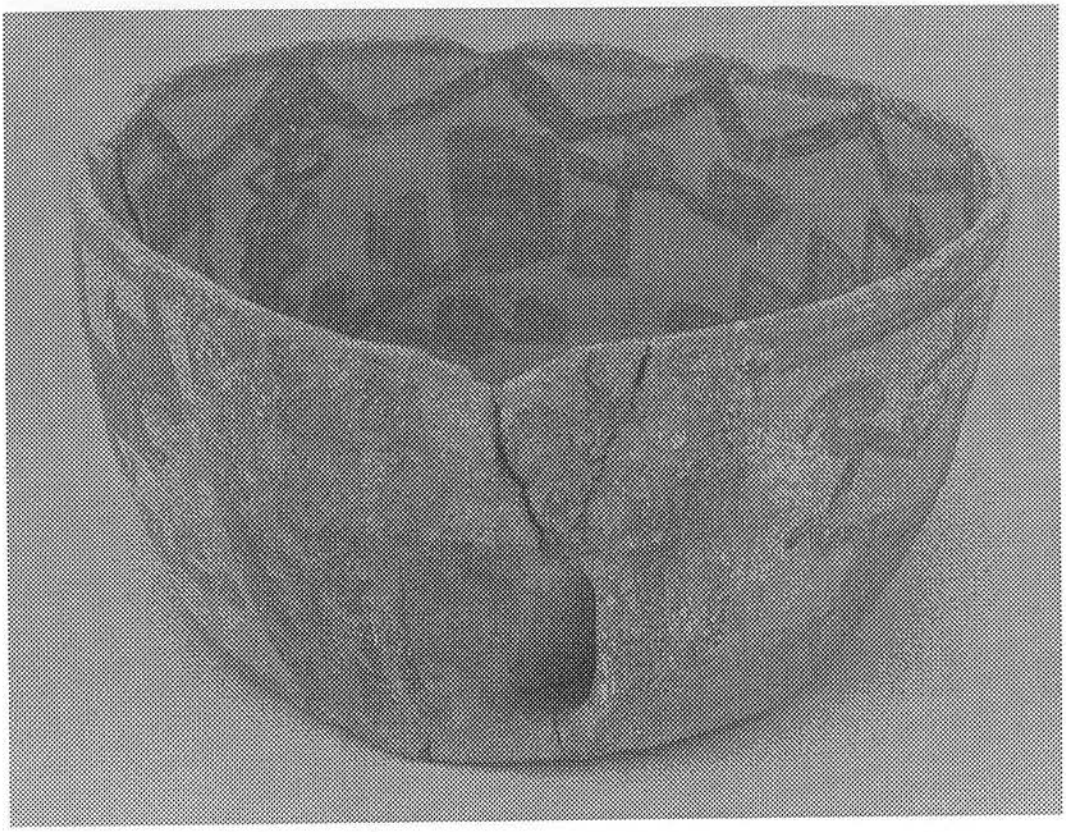
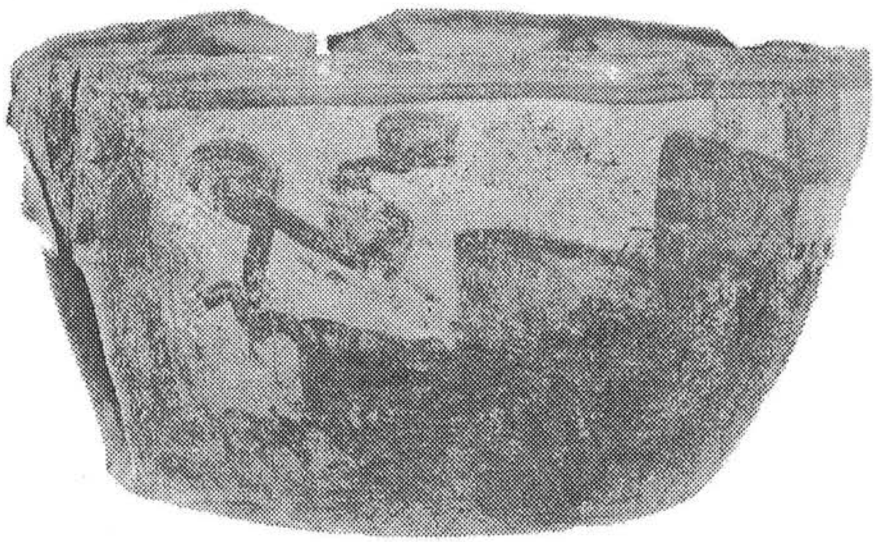


Fig. 44 Building model KM1446, view from the front entrance (above) and from the side (below).



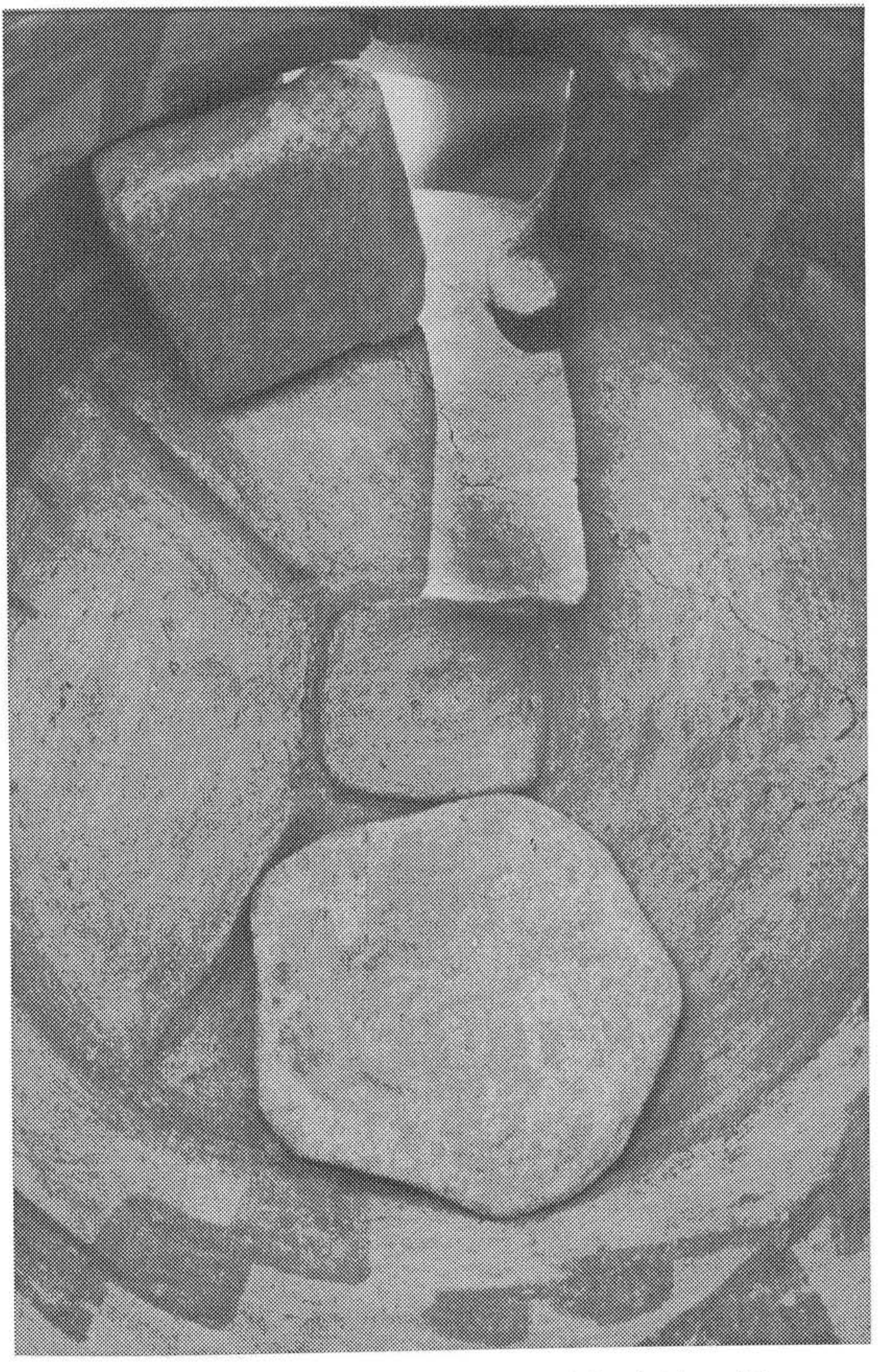


Fig. 45 Building model KM1446 looking into the vessel showing the hearth, ridges and door.

Fig. 46 Building model KM1446 view of the broken tenons above the doorway.

Fig. 47. Plan of Souskiou Village.

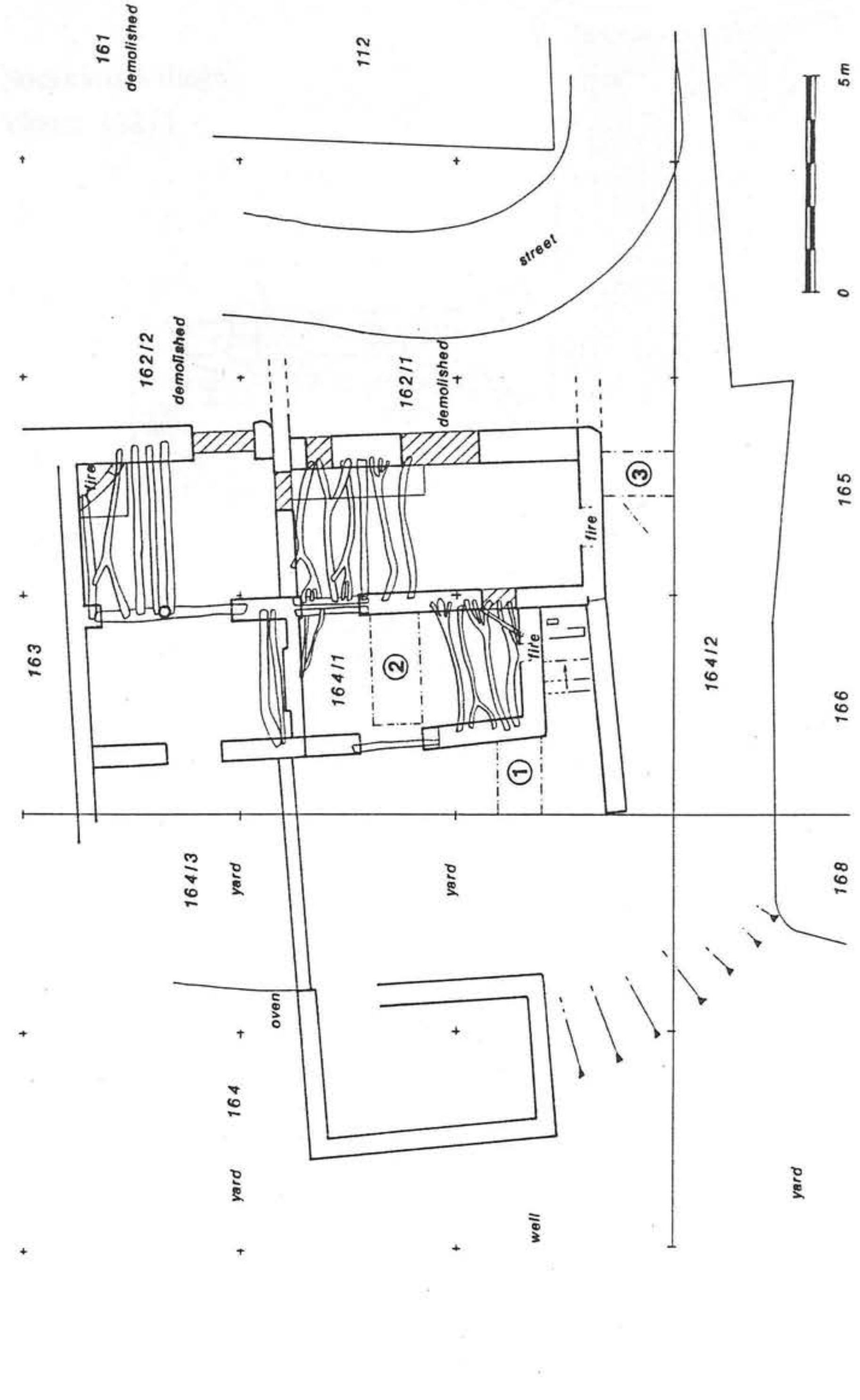


Fig. 48. Plan of House 162/1.

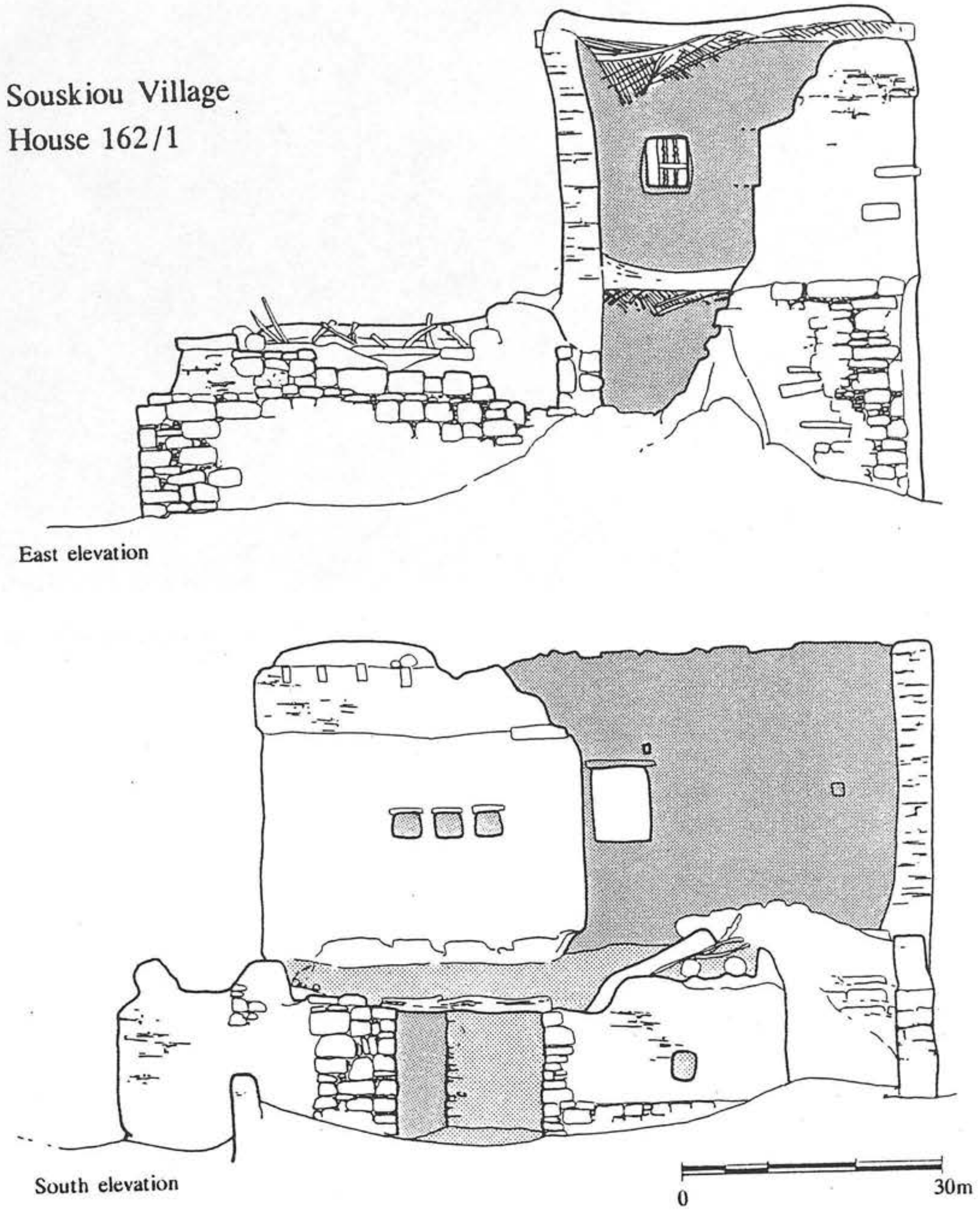


Fig. 49. Elevations of House 162/1.

Fig. 50 View of House 162/1 from the W.

Fig. 51 House 162/1 view of the lower room and staircase (right) from the courtyard.

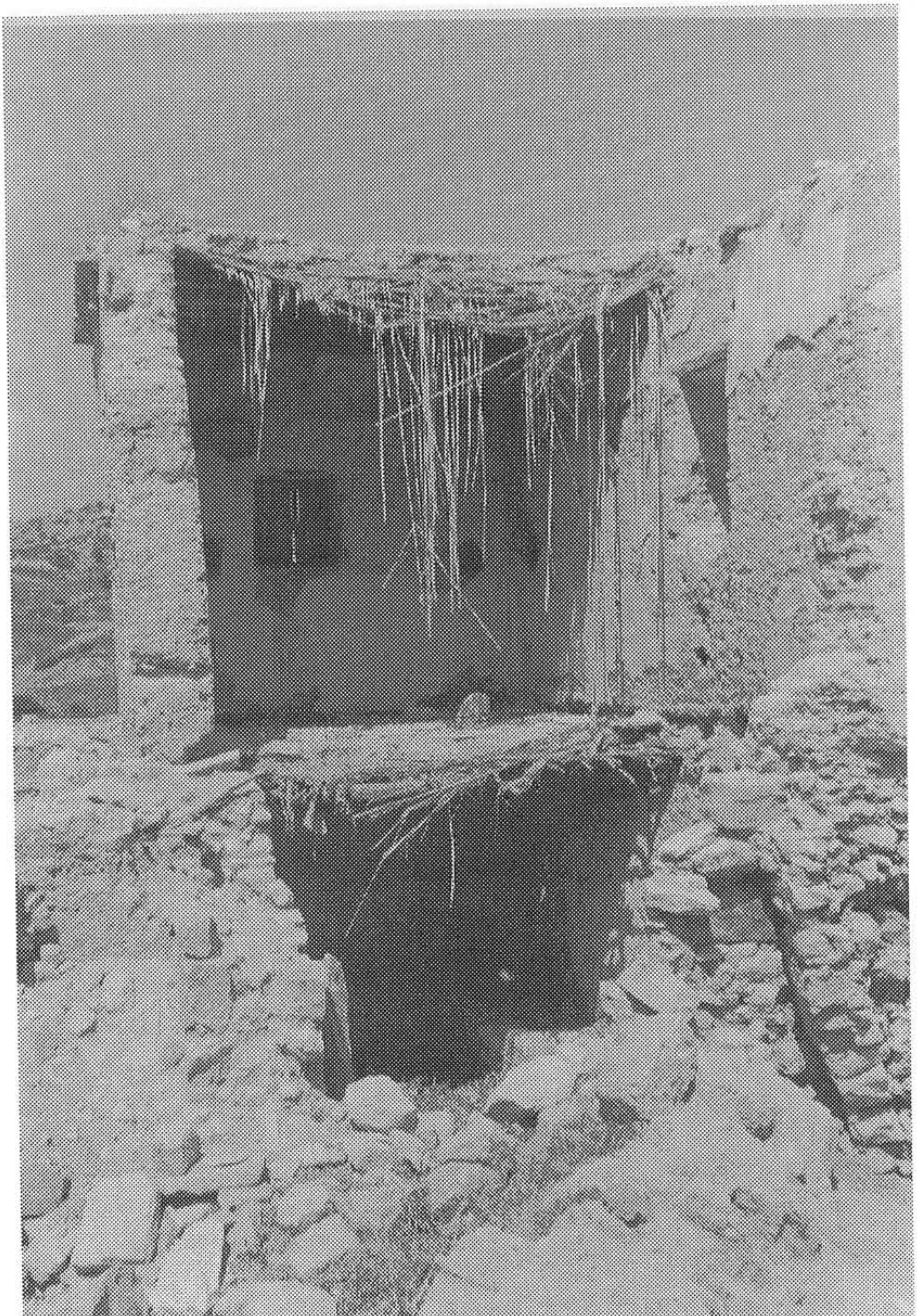


Fig. 52 House 162/1, view from the S showing the collapsed gable, foreground, and the upper storey.

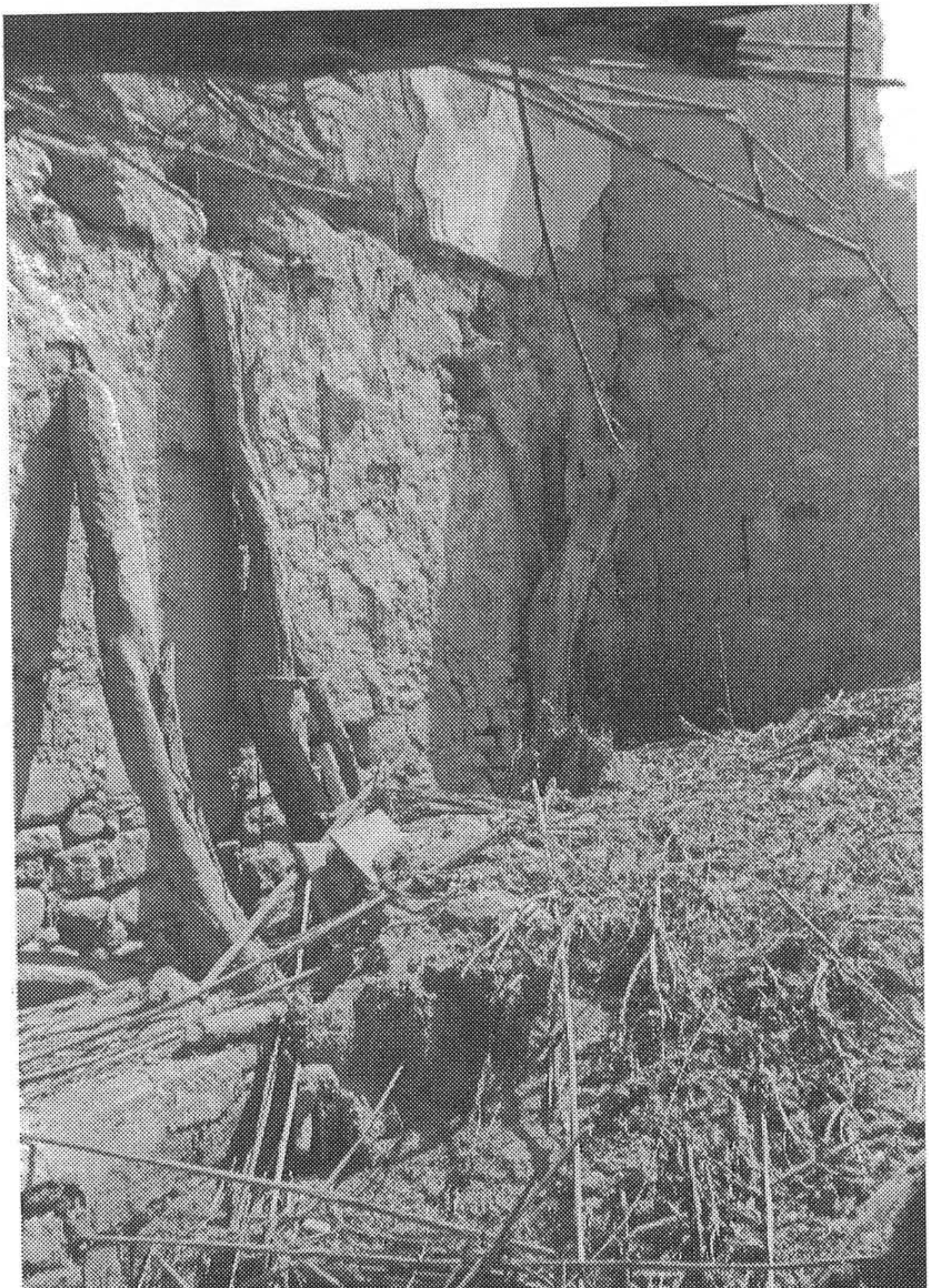


Fig. 53 House 162/1, view of interior of ground floor showing pattern of roof and rafter collapse.

Fig. 54 House 162/1 view of interior rafters in ground floor room.

Fig. 55 View of a porch showing a forked timber support resting on a stone base.

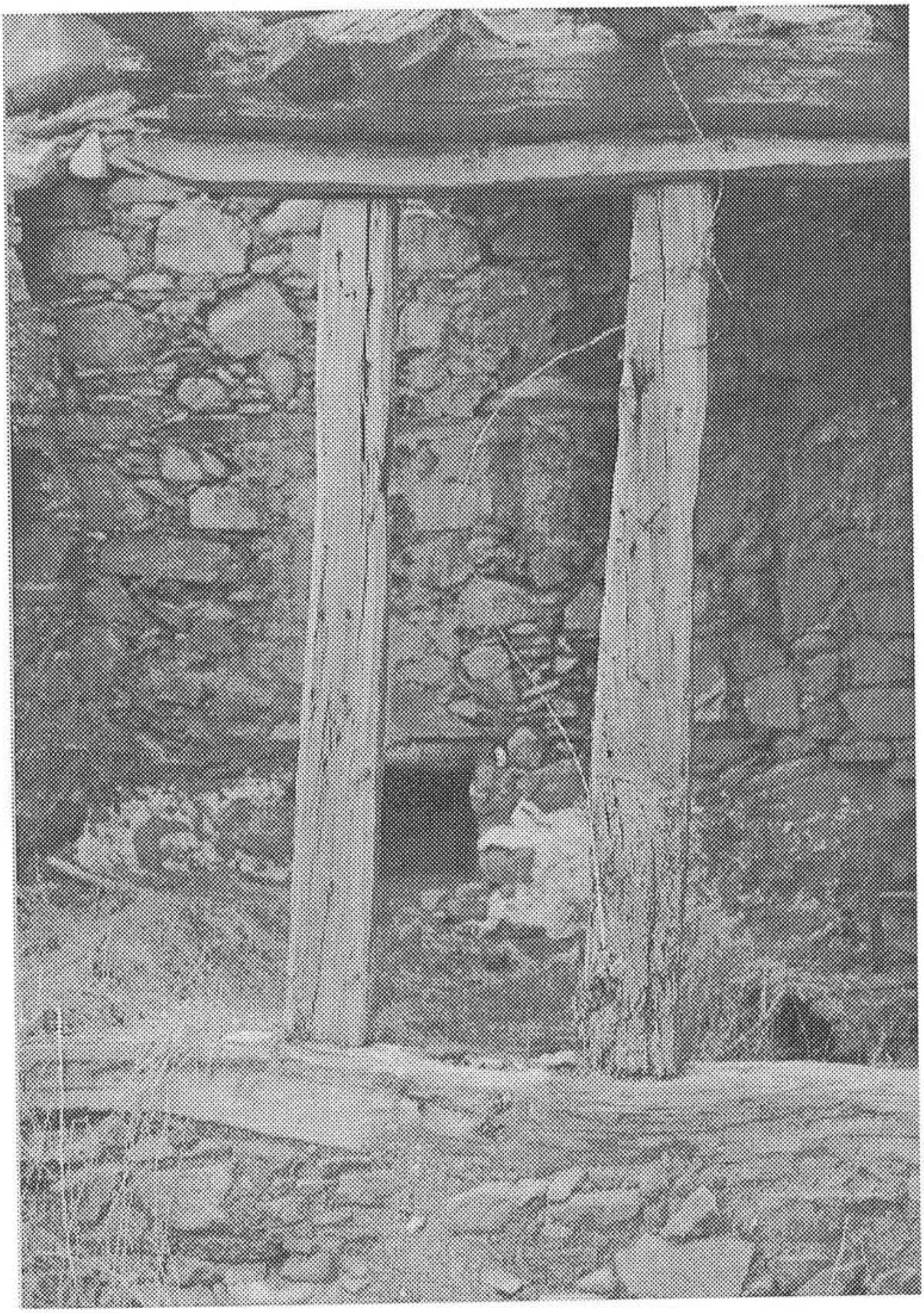


Fig. 56 View showing timber roof supports resting on a sill beam.

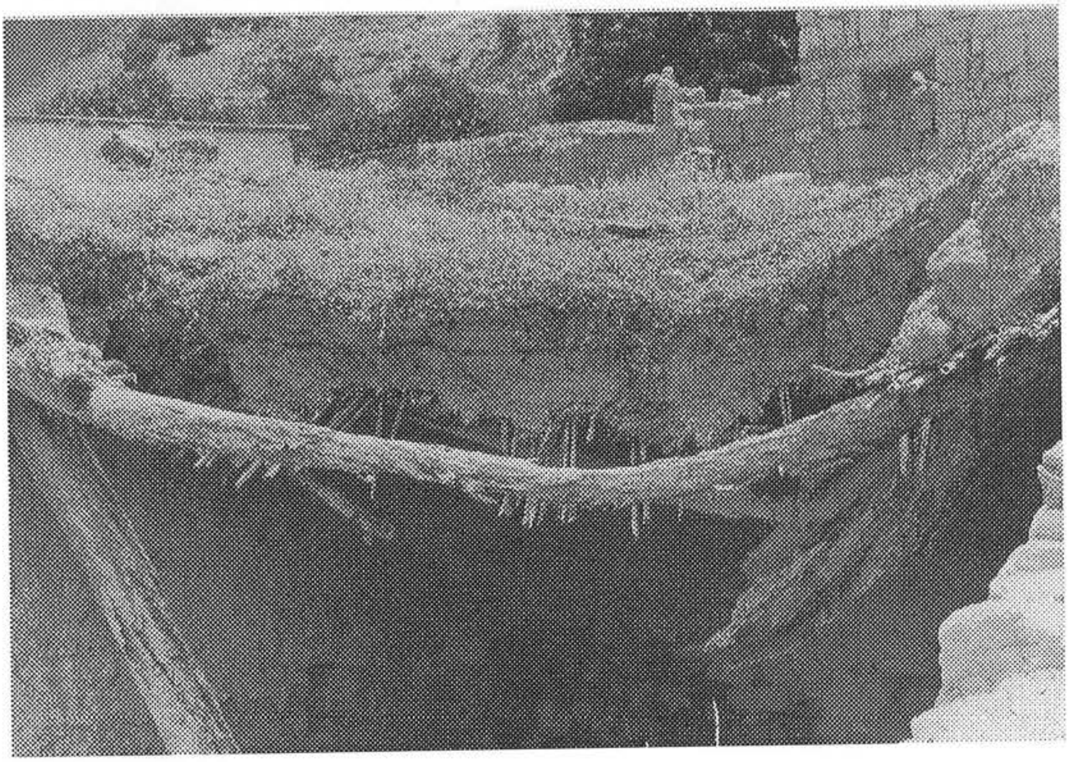


Fig. 57 Detail of soil roof construction.

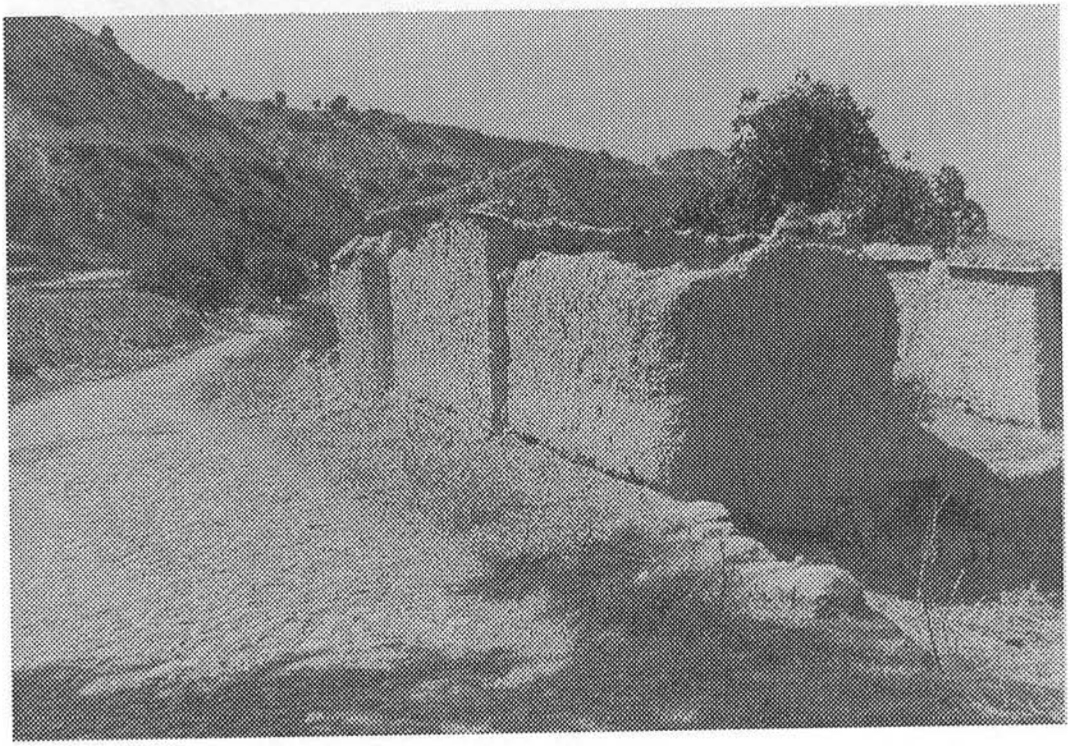


Fig. 58 Detail of mud brick wall being undermined by damp and salt deposition at the junction of the brick and stone footing.

Fig. 59 Collapsed mud brick showing effects of exposure of mortar and brick face to erosion.

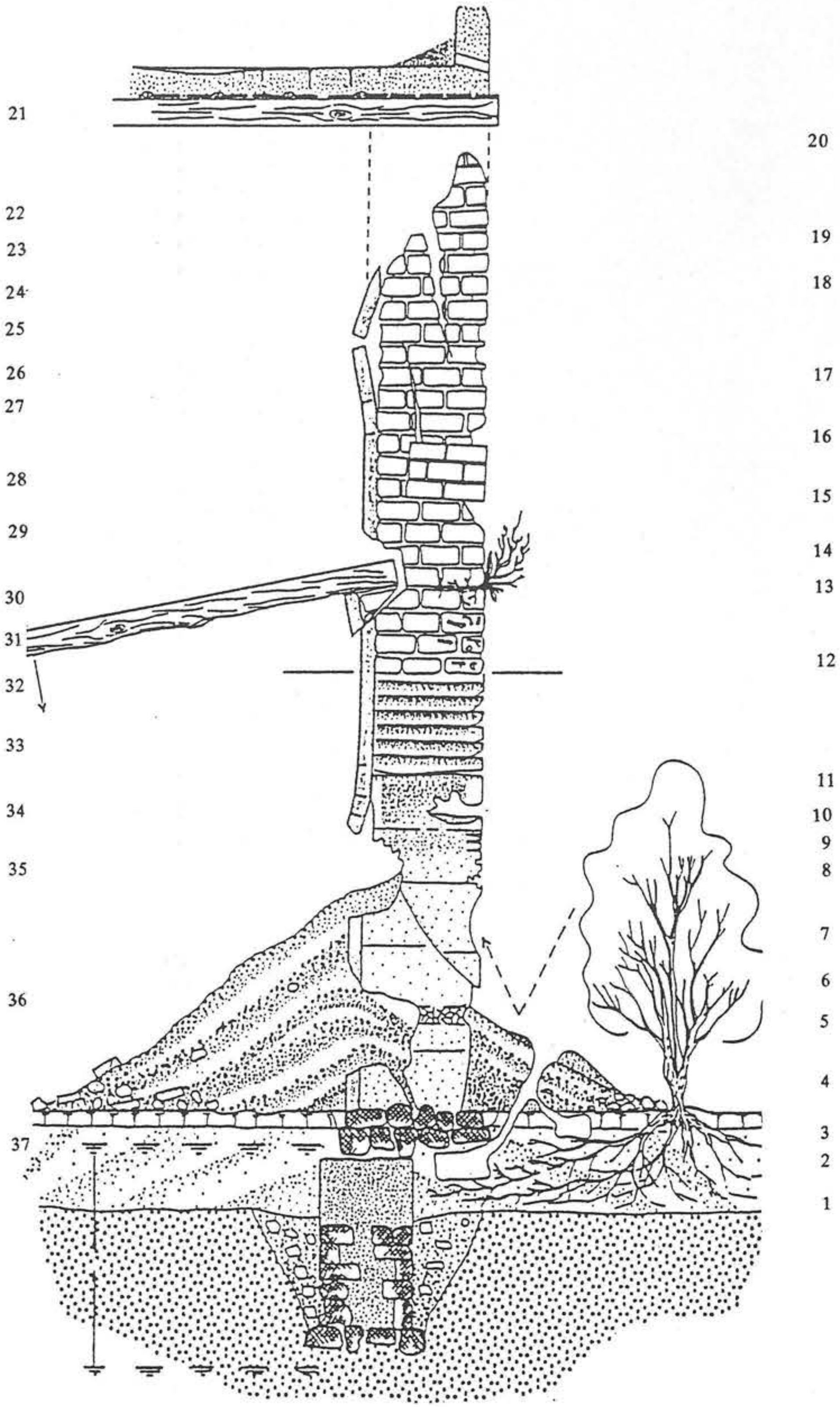


Fig. 60. Diagram showing the various types of erosion affecting mud structures.

Fig. 60. Types of erosion affecting mud structures. (After Hughes 1983, 182-4).

1.Structural movement and cracking caused by foundations built on soft spots such as loose fill or on hard spots such as earlier foundations.
2. Undermining of walls by roots and animals.
3. Inadequate foundations through bad design, e.g. not spreading the load, old foundations, additional storeys, resulting in massive settlement and differential structural movements and cracking.
4. Adjacent vegetation depositing mildew on wall so allowing micro-flora and fauna to establish.
5. A crushed zone leading to the possible collapse of the whole wall. This is caused by load transfer onto a progressively thinner wall with the compressive strength of the soil being ultimately exceeded.
6. A shear zone that, depending upon the internal friction, can lead to the collapse of the wall. The cause is often a surcharge of a mound on one side accompanied by a moisture gradient across the wall thickness.
7. Splash damage by heavy rain and animal urine.
8. The excavation and construction of bee and wasp nests.
9. Shrinkage cracks into the surface of the wall resulting from the soil being too plastic (clayey or micaceous), from being placed with too high a moisture content, from repeated cycles of expansion/contraction and wetting/drying, having insufficient binder or through lumps of soil thrown onto the wall not bonding to the adjacent bits.
10. Bird and animal nests that tend to be excavated at weak points.
11. Shrinkage cracks running horizontally between construction "lifts".
12. Decay of organic inclusions leaving large cavities.
13. The expansion of roots growing into the wall and mortar fabric.
14. Bricks of varying dimensions or no laid properly resulting in the wall load not being spread evenly.
15. Repair of wall with soil materials of different origins or behaviour characteristics resulting in differential weathering.
16. Poorly compacted or weakly cemented bricks (lumps) resulting in a patchwork of cavities.
17. Low density, too wet a mix or weakly cemented mortar.
18. Shrinkage cracks between bricks.
19. Fine silts, sands and stones falling down into seasonal weathering cracks preventing them from closing up and allowing them to become progressively enlarged.
20. Roof eaves overhand too little allowing the rain to run off down the wall. Puddles collect on the roof where it is sagging, so softening the soil.
21. Missing roof allowing both sides of the wall to be subject to decay.
22. Rain, sheet and linear run-off causing surface decay and incised vertical channels. Soil binders such as clay and salts are washed out. Pore pressures are increased causing spalling off soil fragments. High humidity conditions decrease the soils compressive strength. Soluble salts expand and contract proportionally to the moisture content.
23. Wind causing an overturning action by redirecting the distribution of dead load; the base of the wall on one side will have an increased stress while the other may be subject to increased tensile strain.
24. Sun causes differential expansion across the wall thickness causing stress strains and exfoliation. Freezing causes pore expansion.
25. Rain and temperature action causes chemical decomposition. Mica, feldspar break down clay minerals and calcite breaks down into smaller particles destroying the clay structure.
26. Poor bonding of render and backing material leading to splitting off of the render.
27. Straight joints between different sections of wall causes loss of structural integrity and mutual support.
28. Putlog holes or ornamental detailing forming points of weakness.
29. Rotting wood joists, frames, internal supports etc. softens soil by acting as a moisture reservoir.
30. Falling joist levers off lumps of soil.
31. No wall plate causing joists to crush or shear off the soil below.
32. A row of joists forms a horizontal line of weakness.
33. Wall fabric compacted by heavy rammers into thin layers but too thick to maximise through the total thickness of each layer resulting in layers being made up of materials of banded different particle sizes.
34. Individual lifts being brought up in poorly compacted slurry.
35. Capillary action of moisture can cause salt efflorescing and spalling creating cavities and areas of weakness.
36. Water running down cracks and channels can run inside the wall structure producing channels.
37. Change of hydrological conditions. A rise of water level can soften the soil and induce the capillary rise of water up the wall while a lowering of the water level can consolidate and harden the soil but will lead to shrinkage.

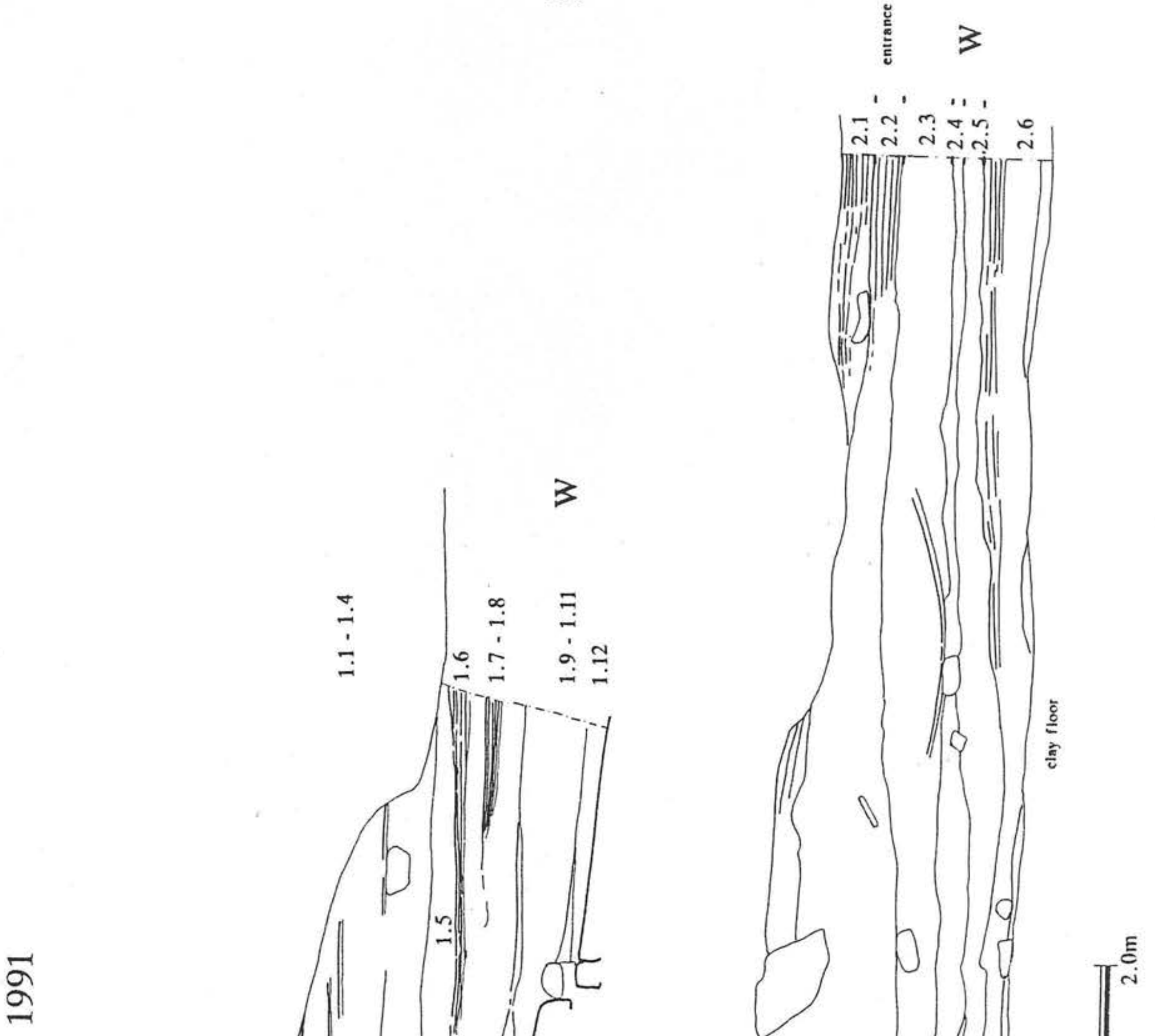


Fig. 61. House 162/1 excavation sections.

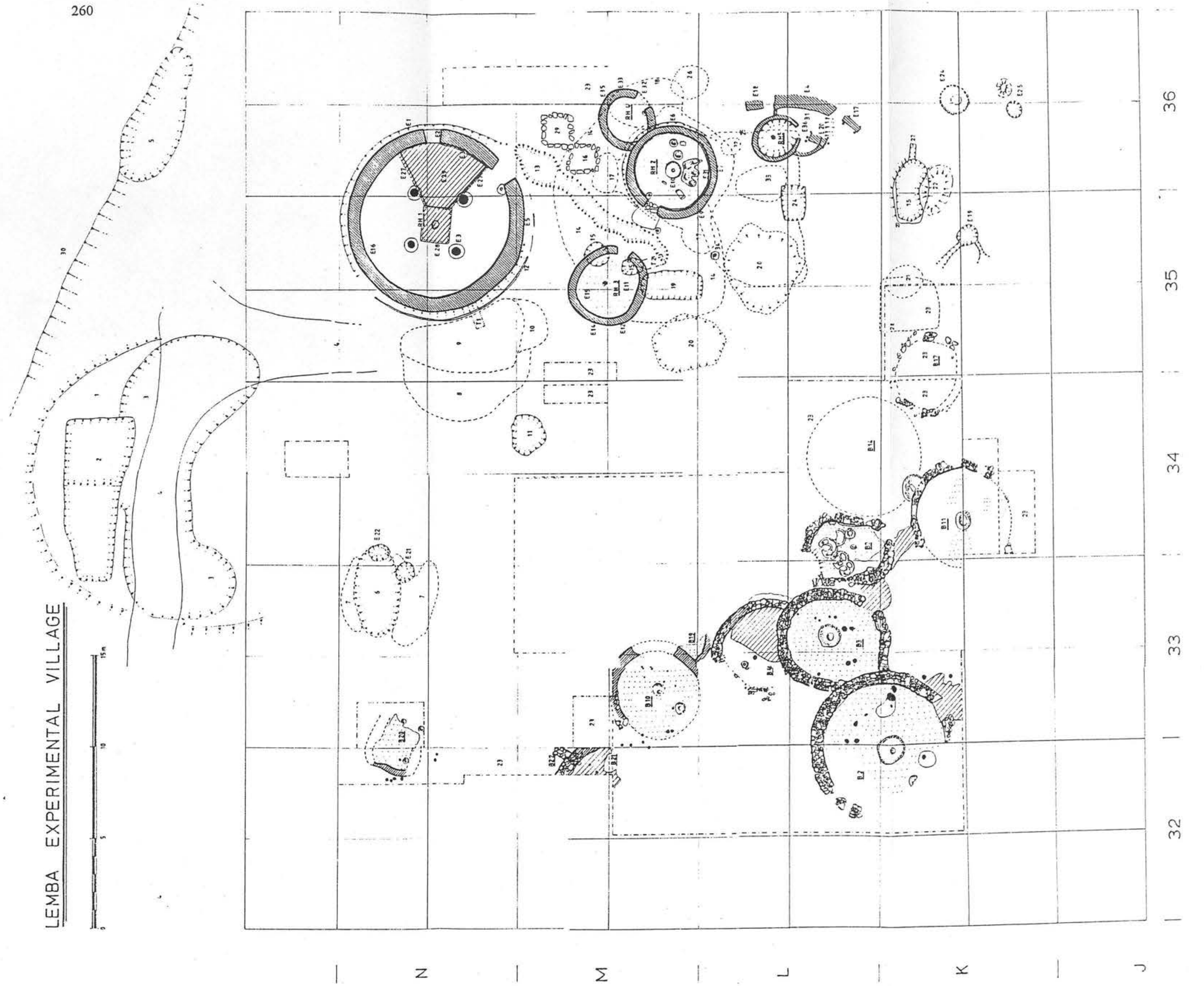


Fig. 62. Plan of the Lemba Experimental Village.

Fig. 63 LEV, view of the village from the E with the excavations just visible beyond the reconstructions.

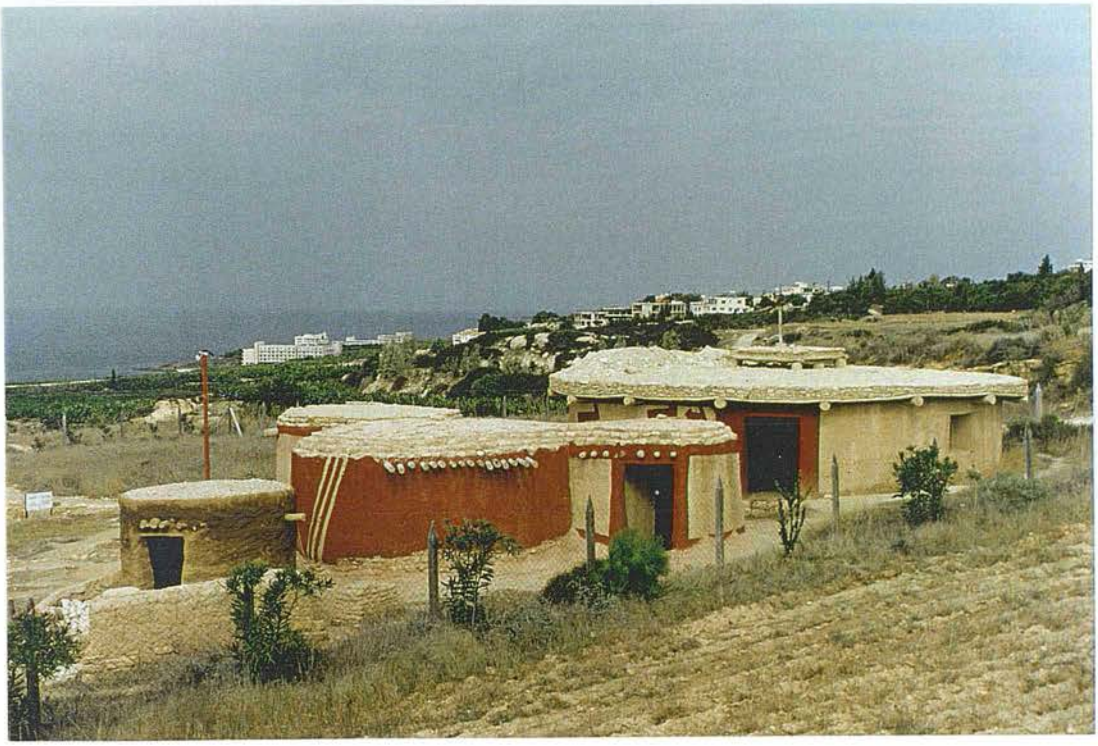


Fig. 64. LEV, view of the village from the E.

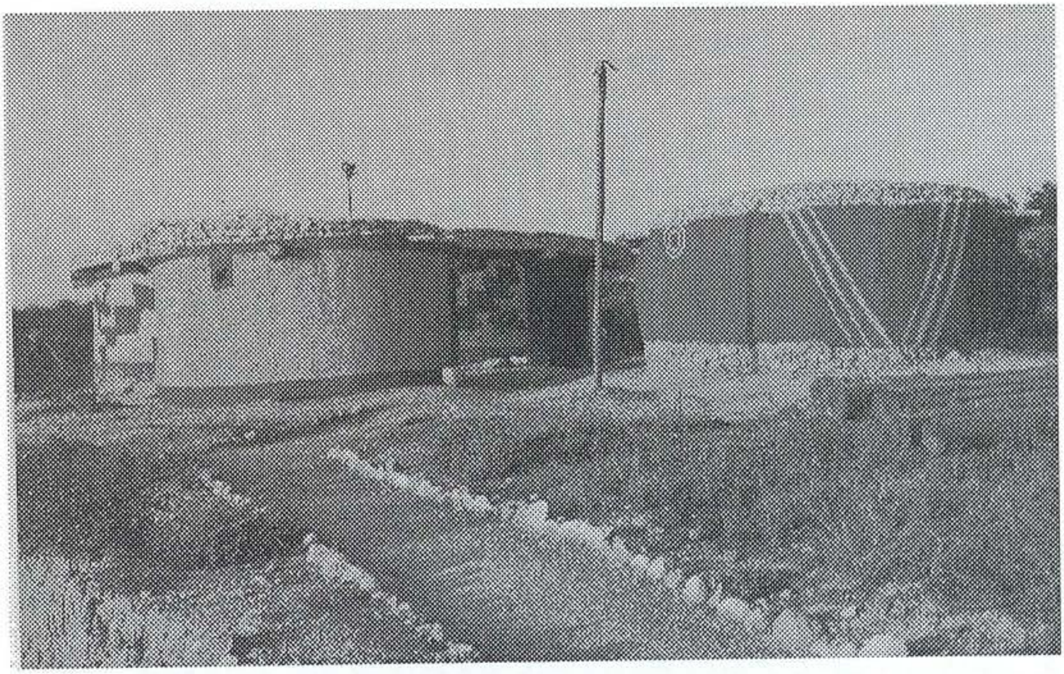


Fig. 65 LEV, approach to the reconstructions from the excavations. RH3 is to the left and RH2 to the right with RH1 visible through the gap.

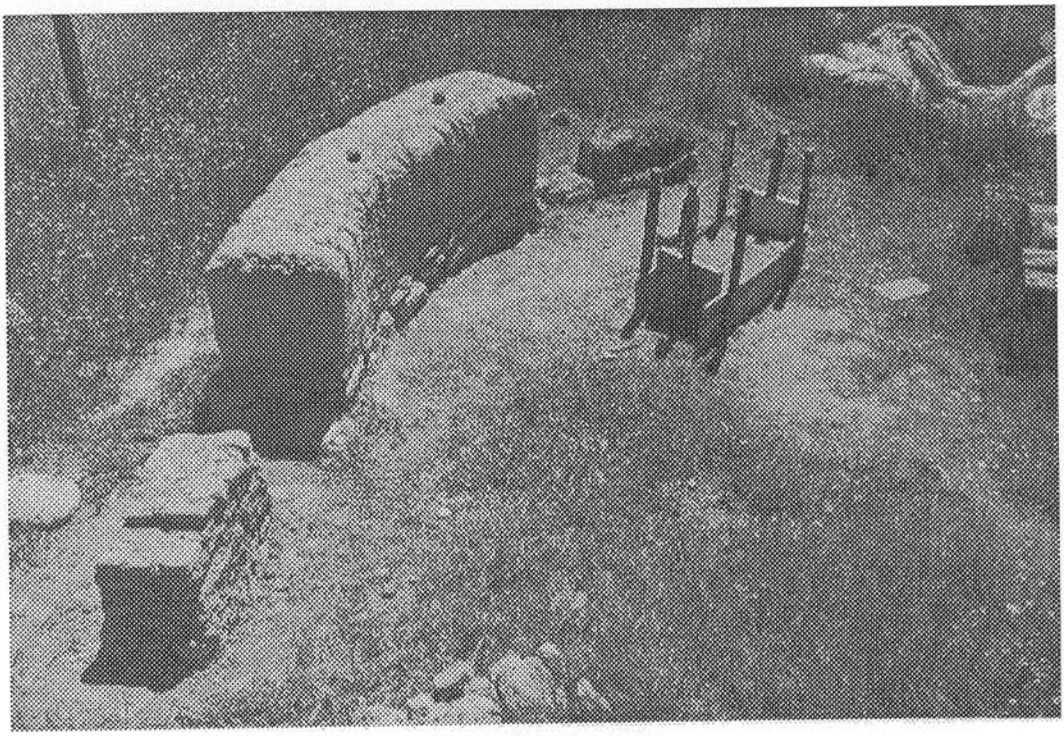


Fig. 66 LEV, view of the experiments in wall construction, E4, E17, E18 and E20.

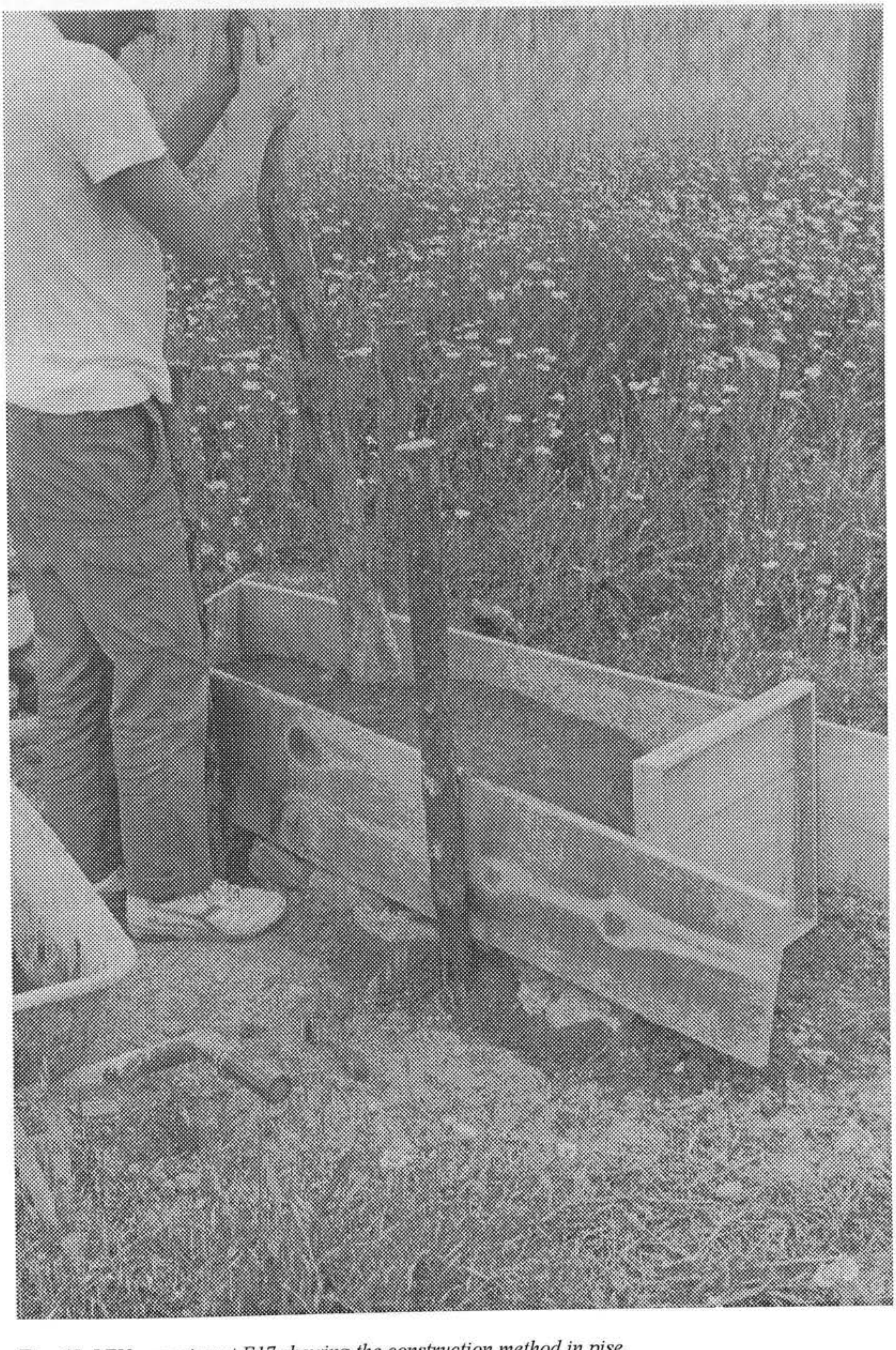


Fig. 67 LEV, experiment E17 showing the construction method in pise.

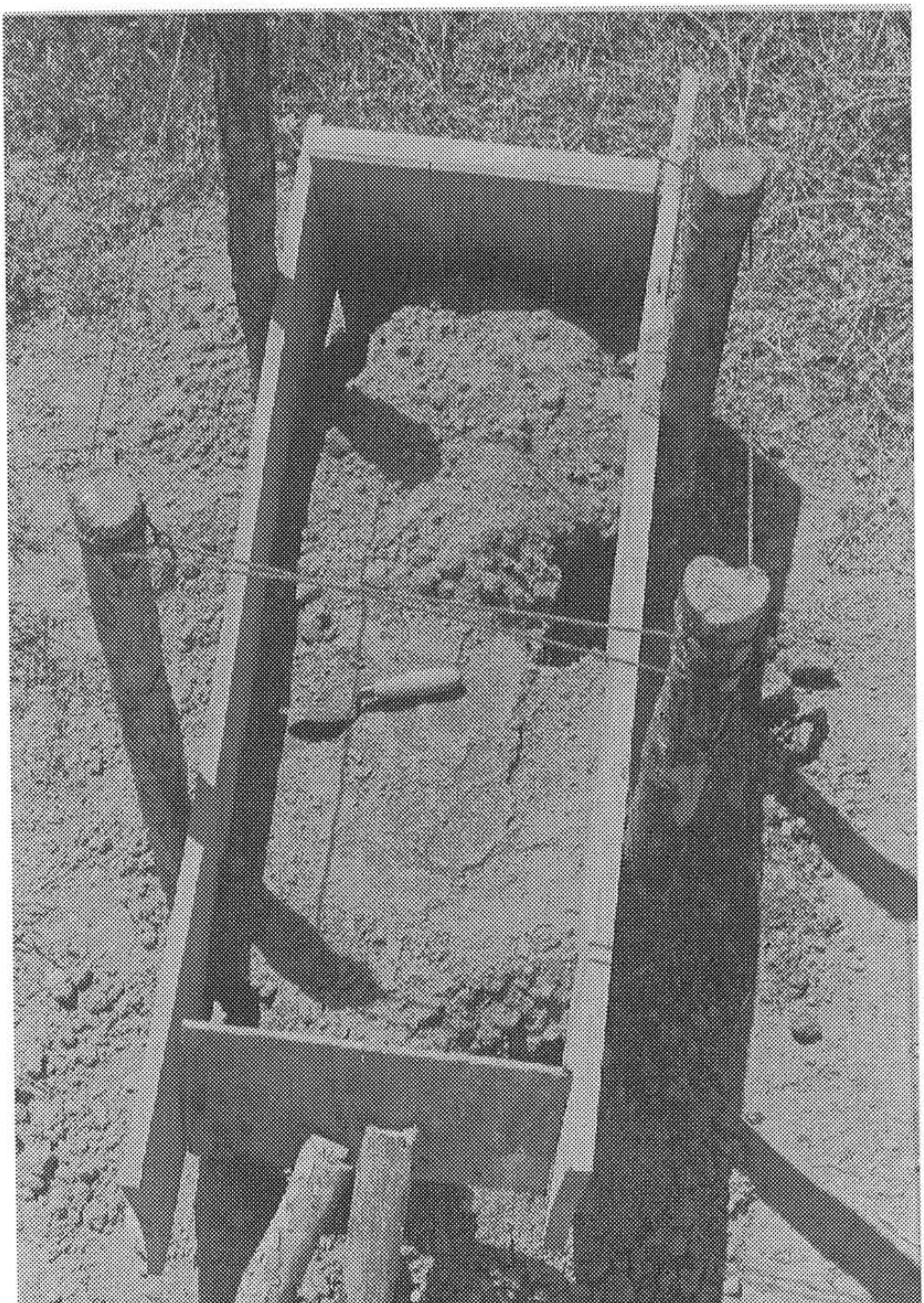


Fig. 68 LEV, experiment E17 showing failure during construction.

Fig. 69 LEV, experiment E17 after removal of the shutters showing the collapse over the stone footing.

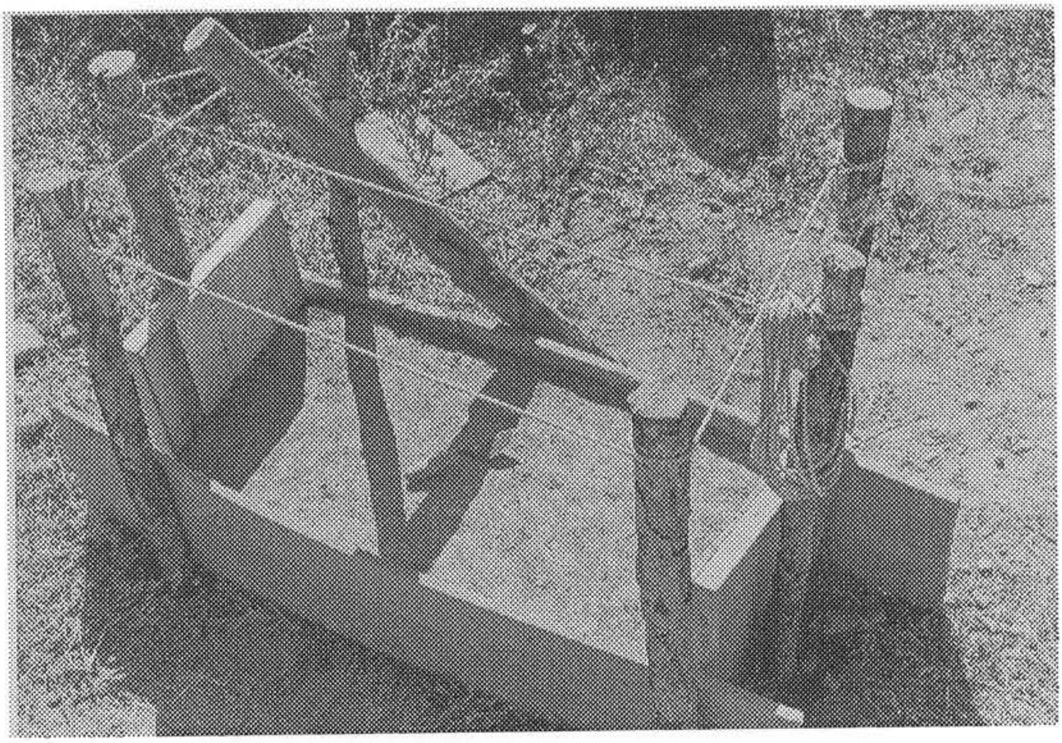


Fig. 70 LEV, pise experiment E20 during construction.

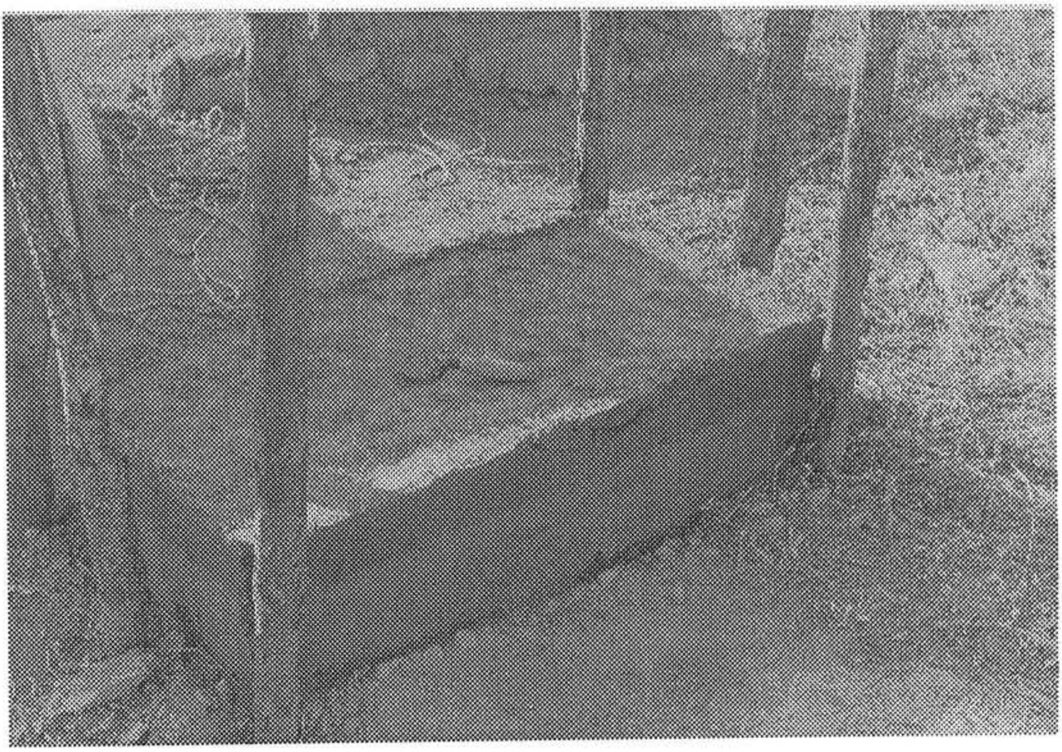


Fig. 71 LEV, pise experiment E20 after removal of the shutters.

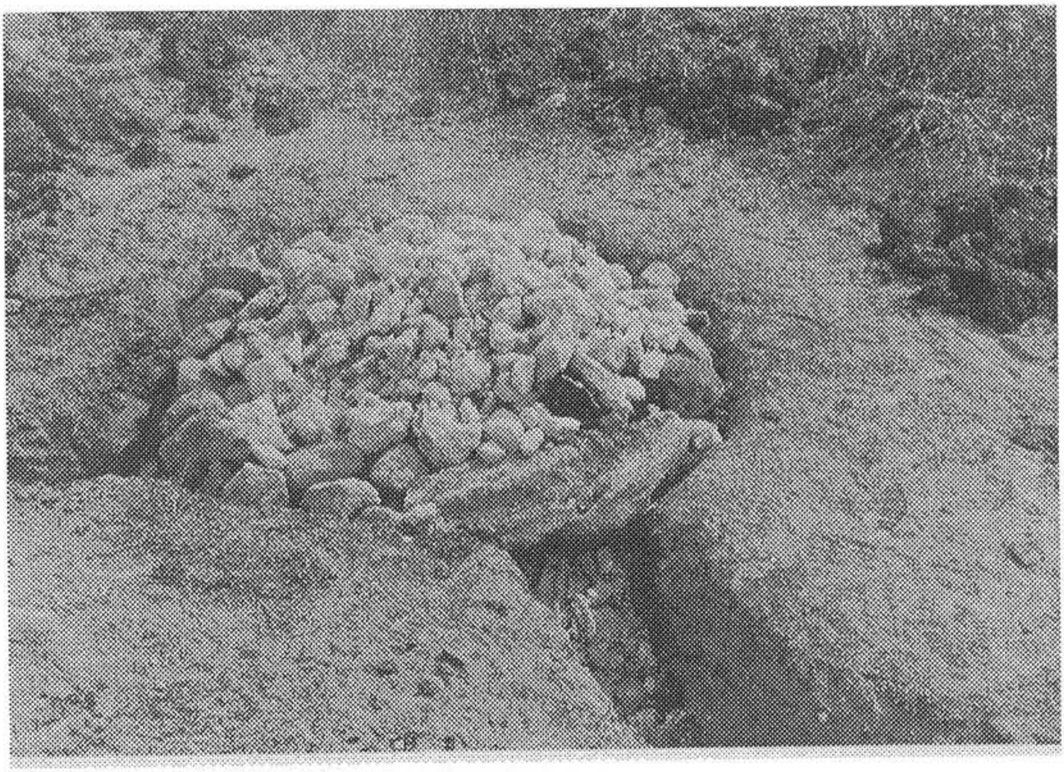


Fig. 72 LEV, lime kiln E19 showing domed shape before firing and flues.

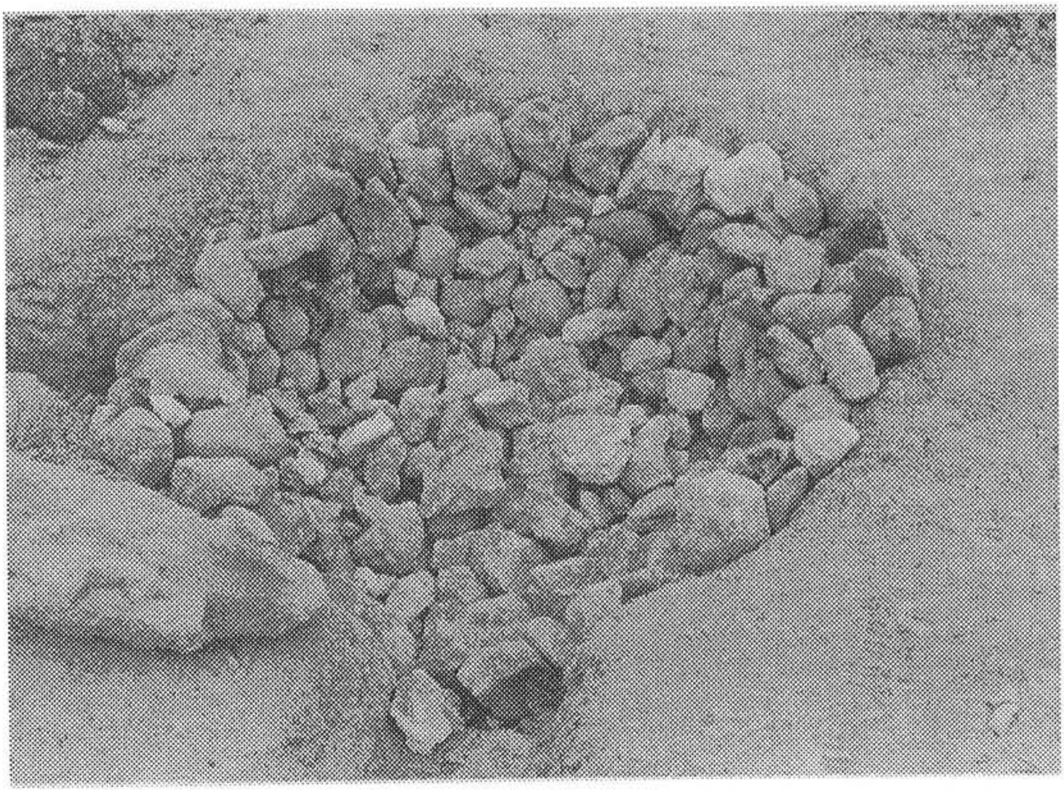


Fig. 73 LEV, lime kiln E19 after firing.

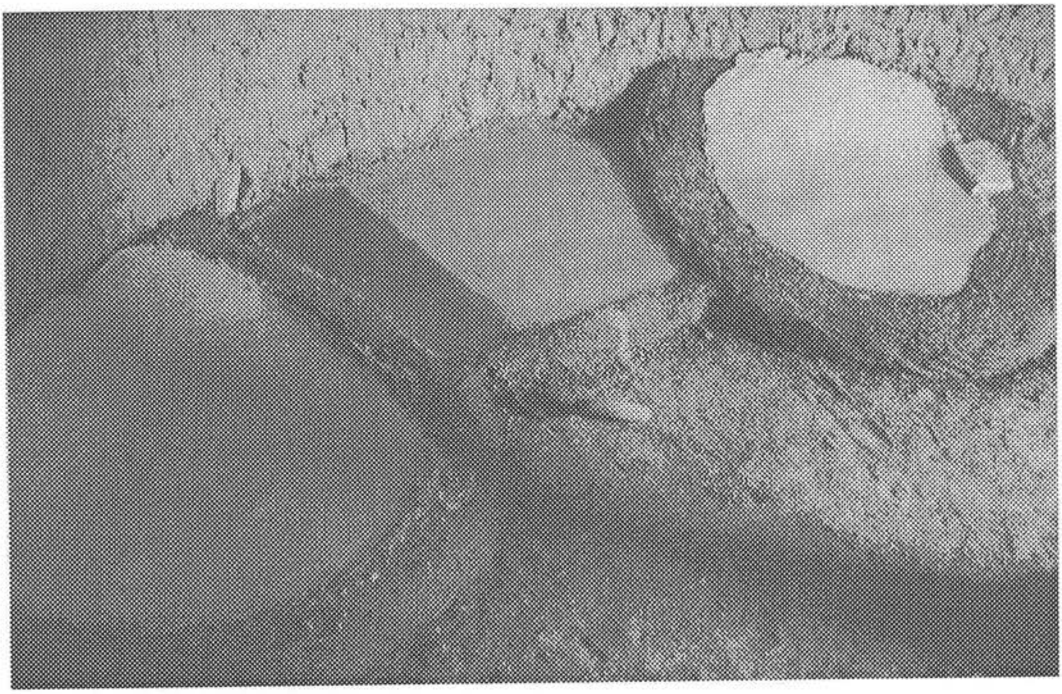


Fig. 74 LEV, test plaster patches E15 from kiln firing E19 in RH3.

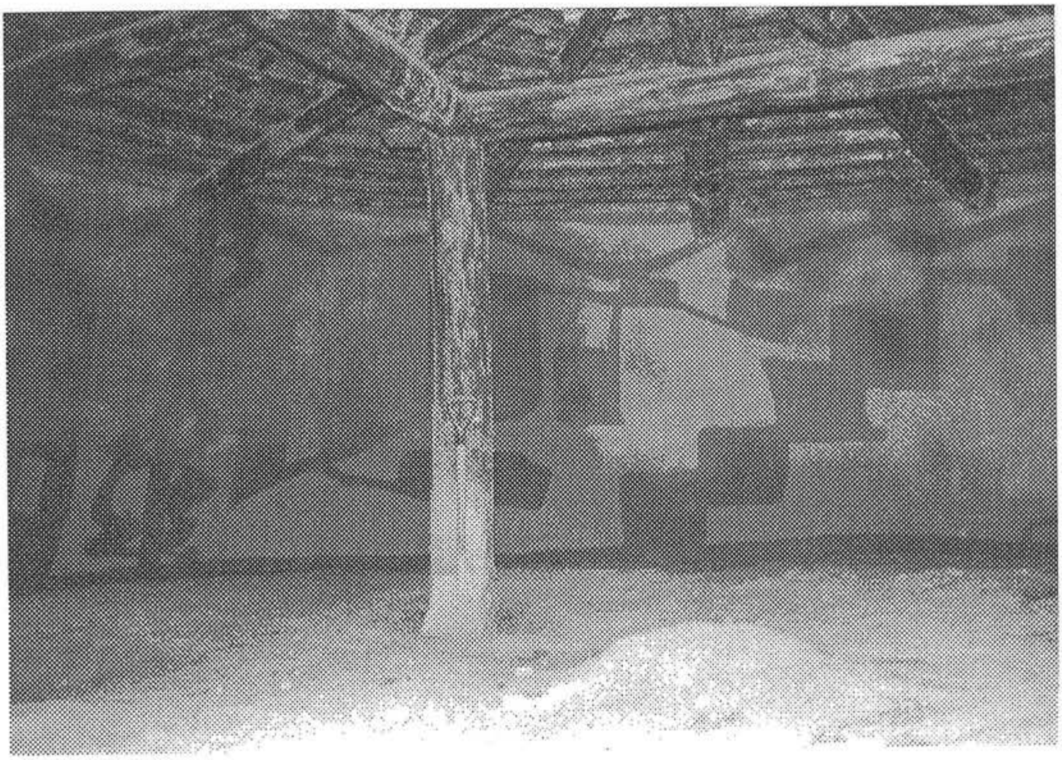


Fig. 75 LEV, interior view of RH1 showing the mural on back wall of the building.

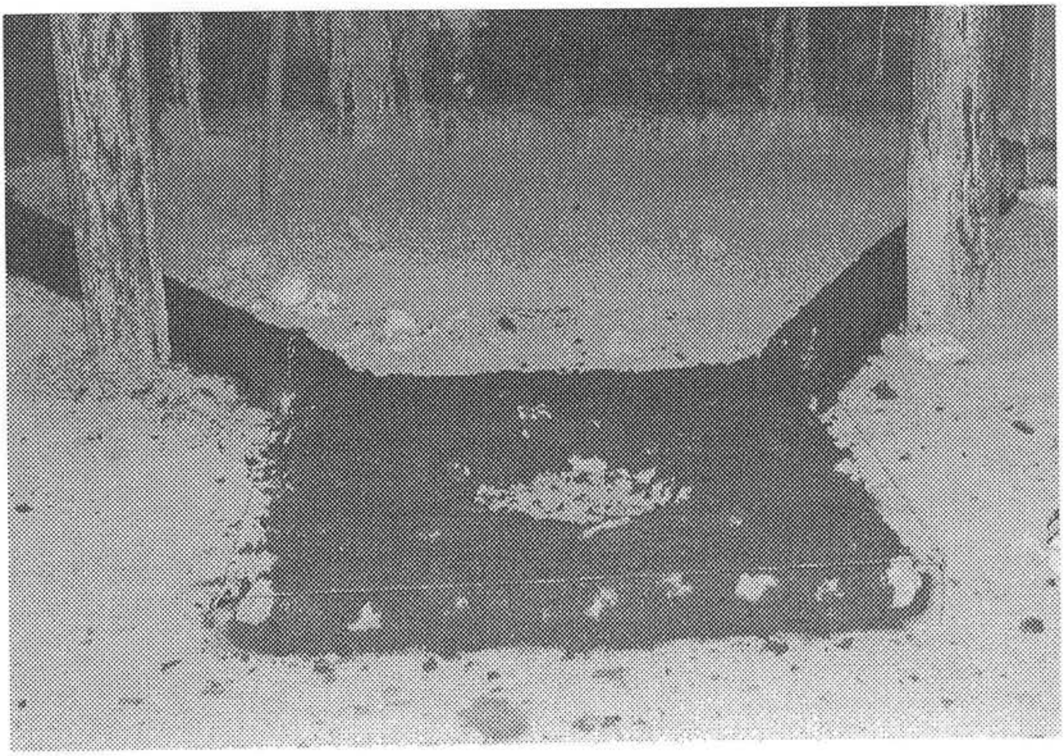


Fig. 76 LEV, interior of RH1 with the mud and stone base of the hearth and ridges under construction.

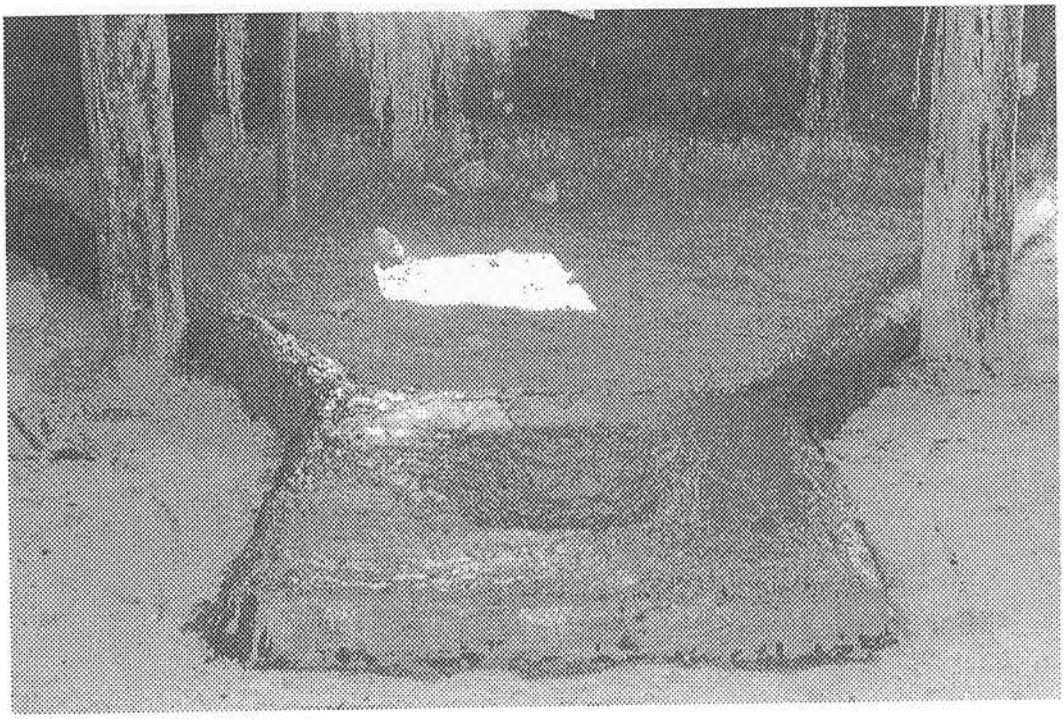


Fig. 77 LEV, interior of RH1 showing the first plaster layer on the hearth and ridges.

Fig. 78 LEV, hearth in RH1 with sherds embedded into first plaster layer.

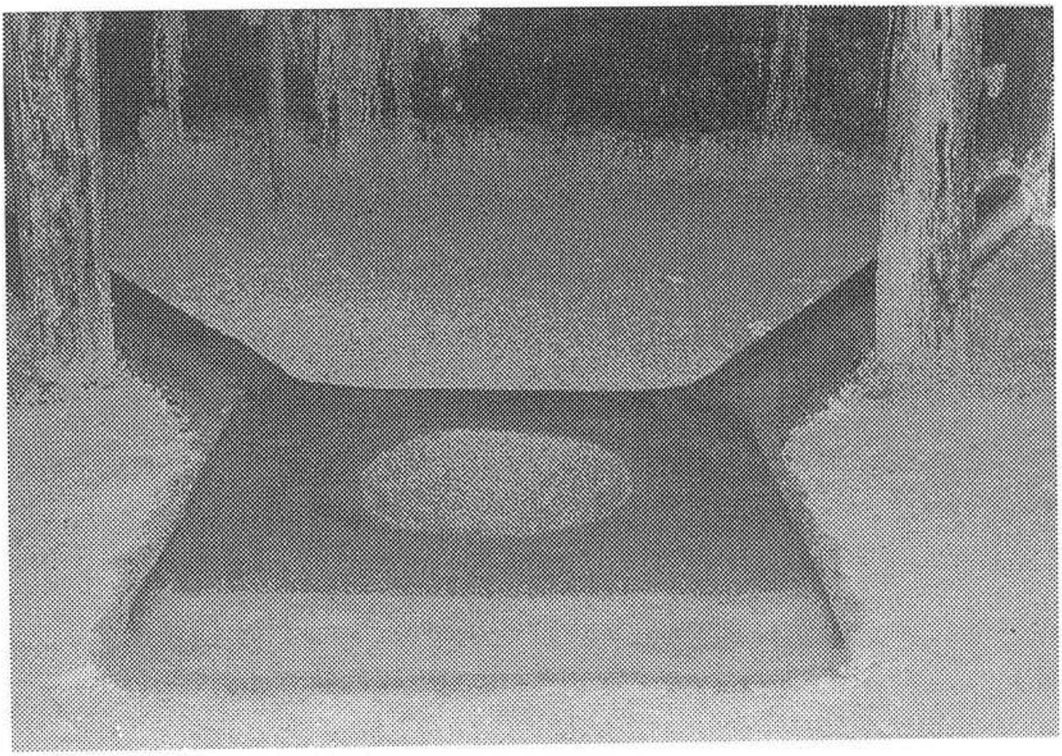


Fig. 79 LEV, completed hearth and ridges in RH1.

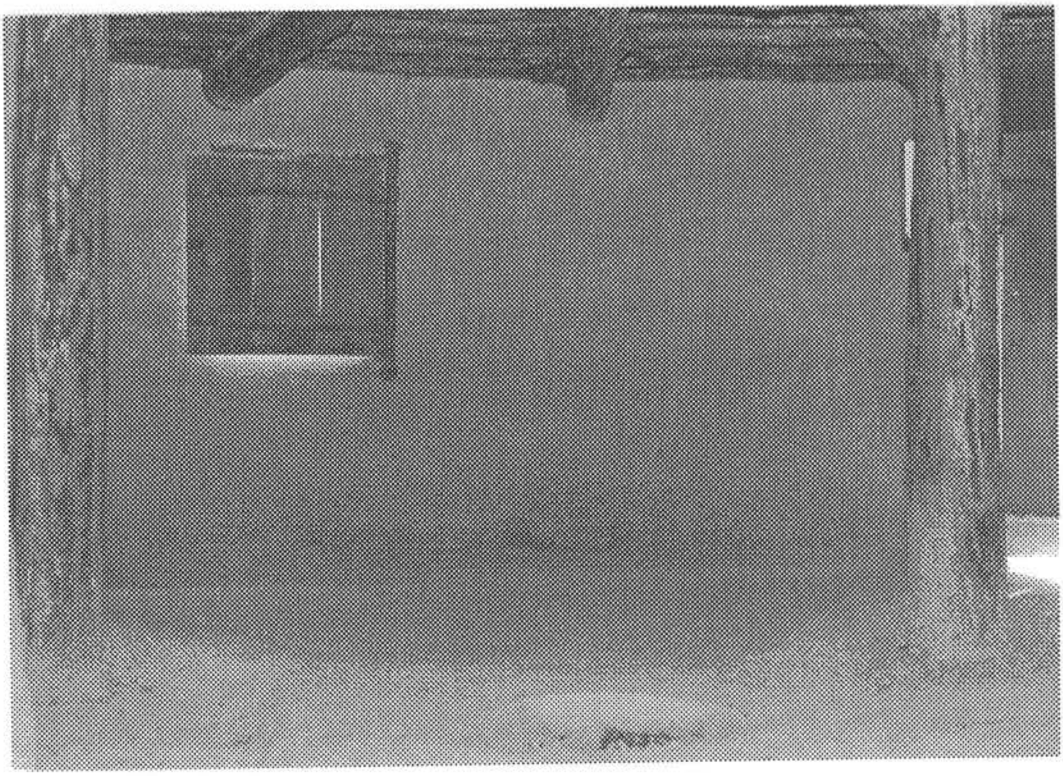


Fig. 80 LEV, interior of RH1 with completed floor, wall plaster and hearth.

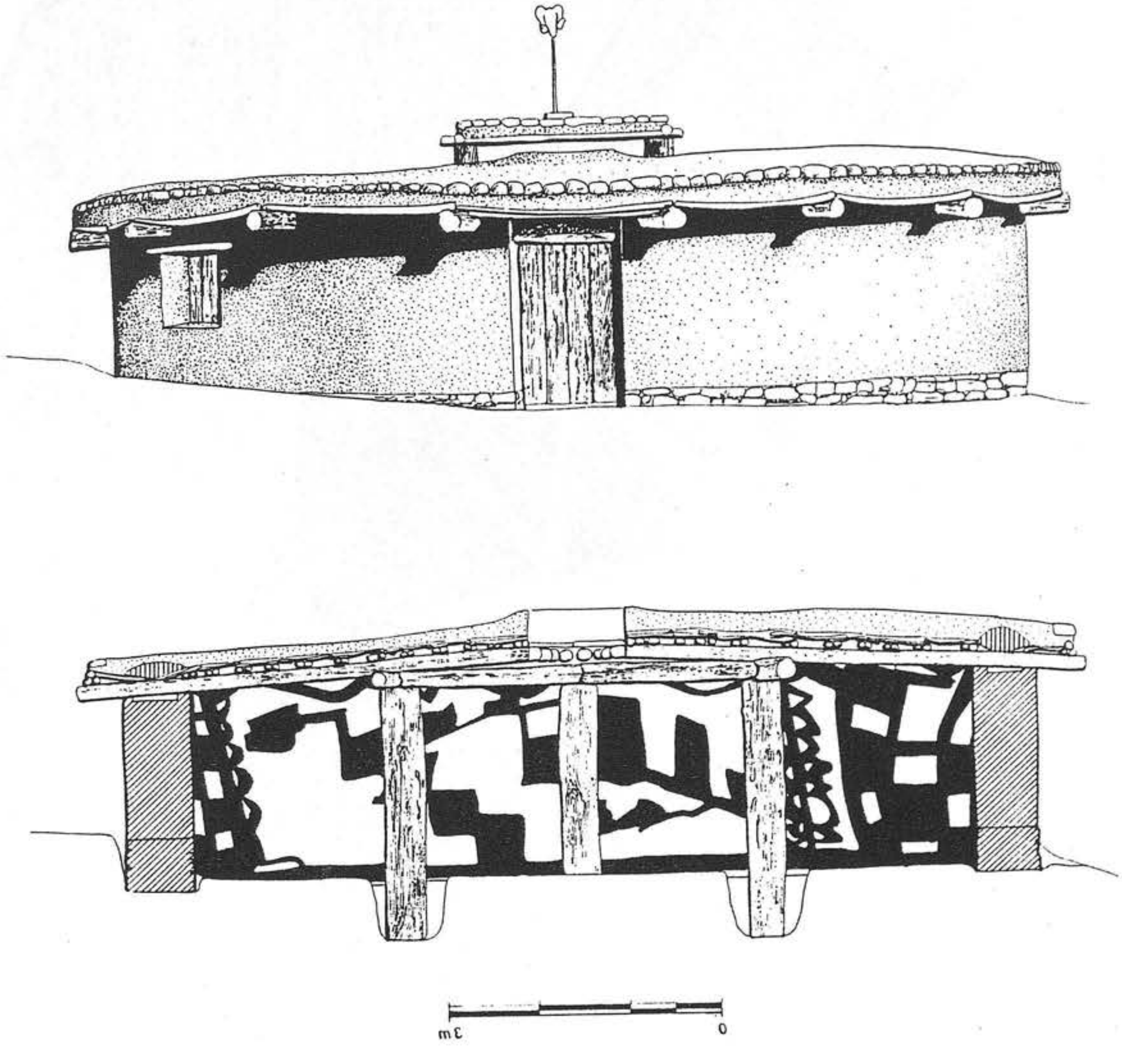


Fig. 81. LEV: RH1 elevation and section.

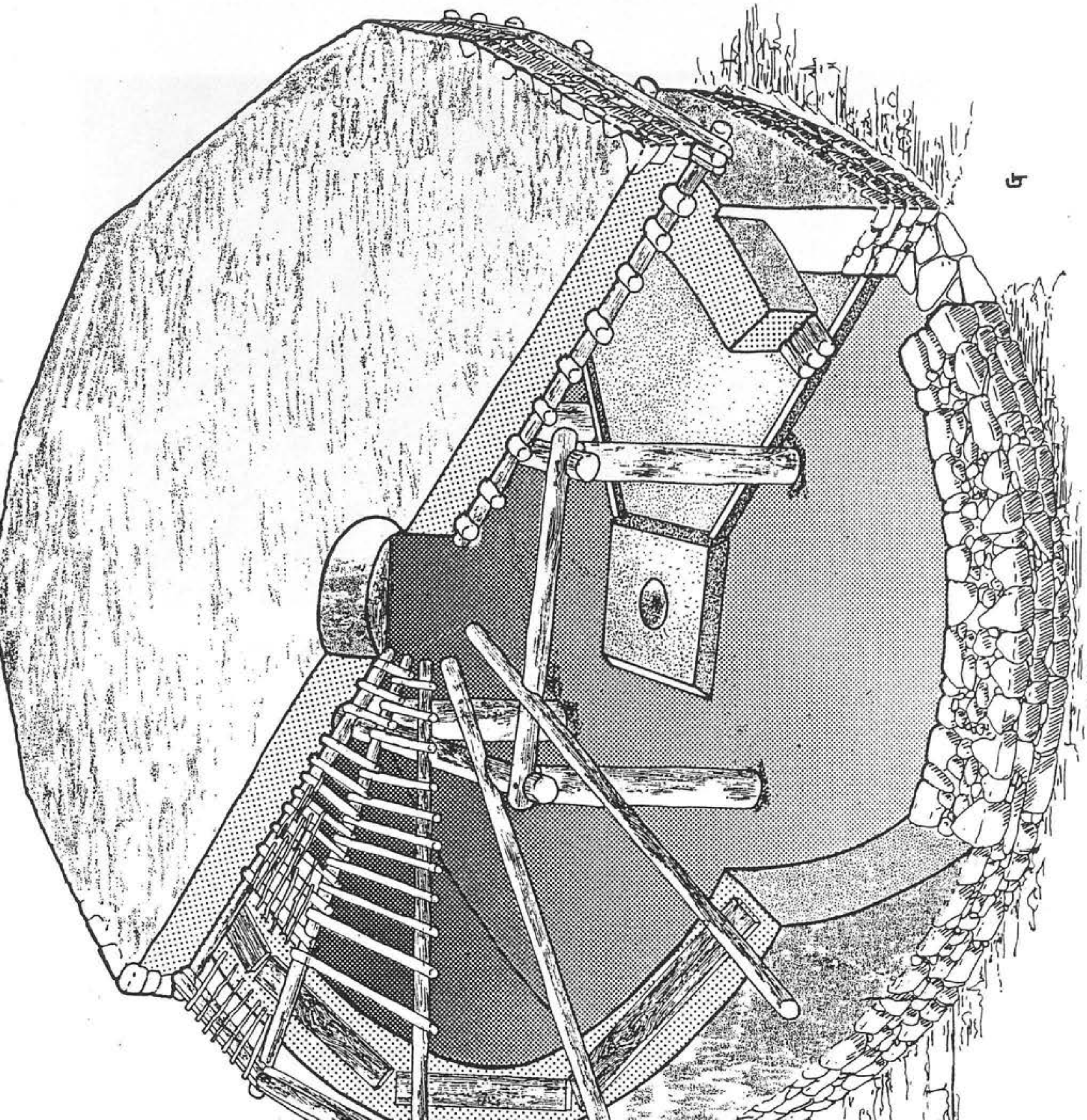


Fig. 82. LEV: RH1 isometric view.

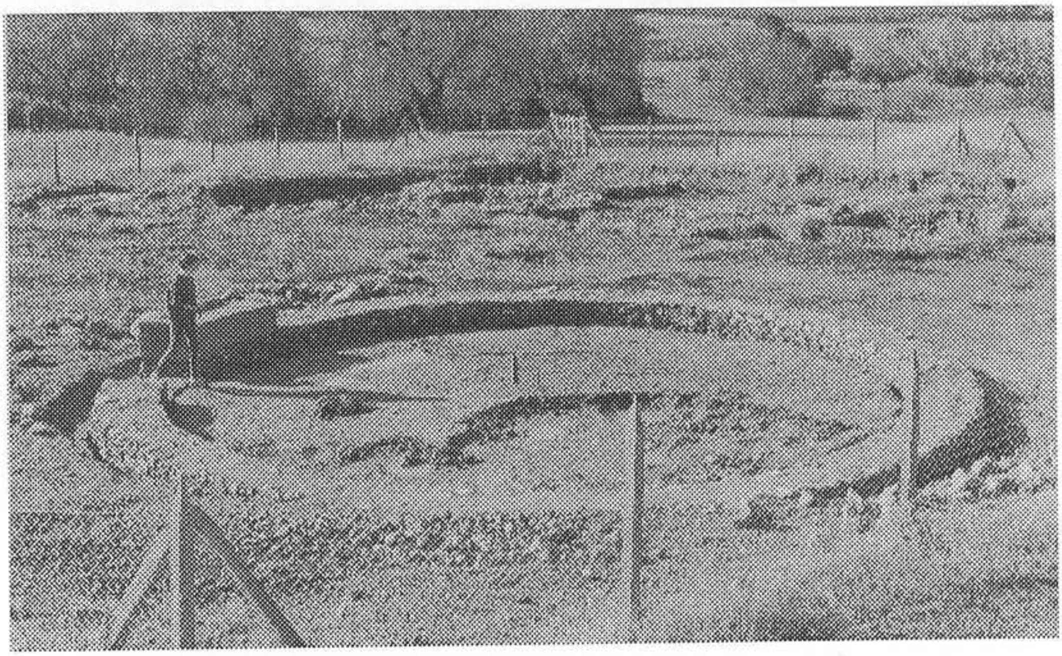


Fig. 83 LEV, RH1 showing the stone footing from the E.

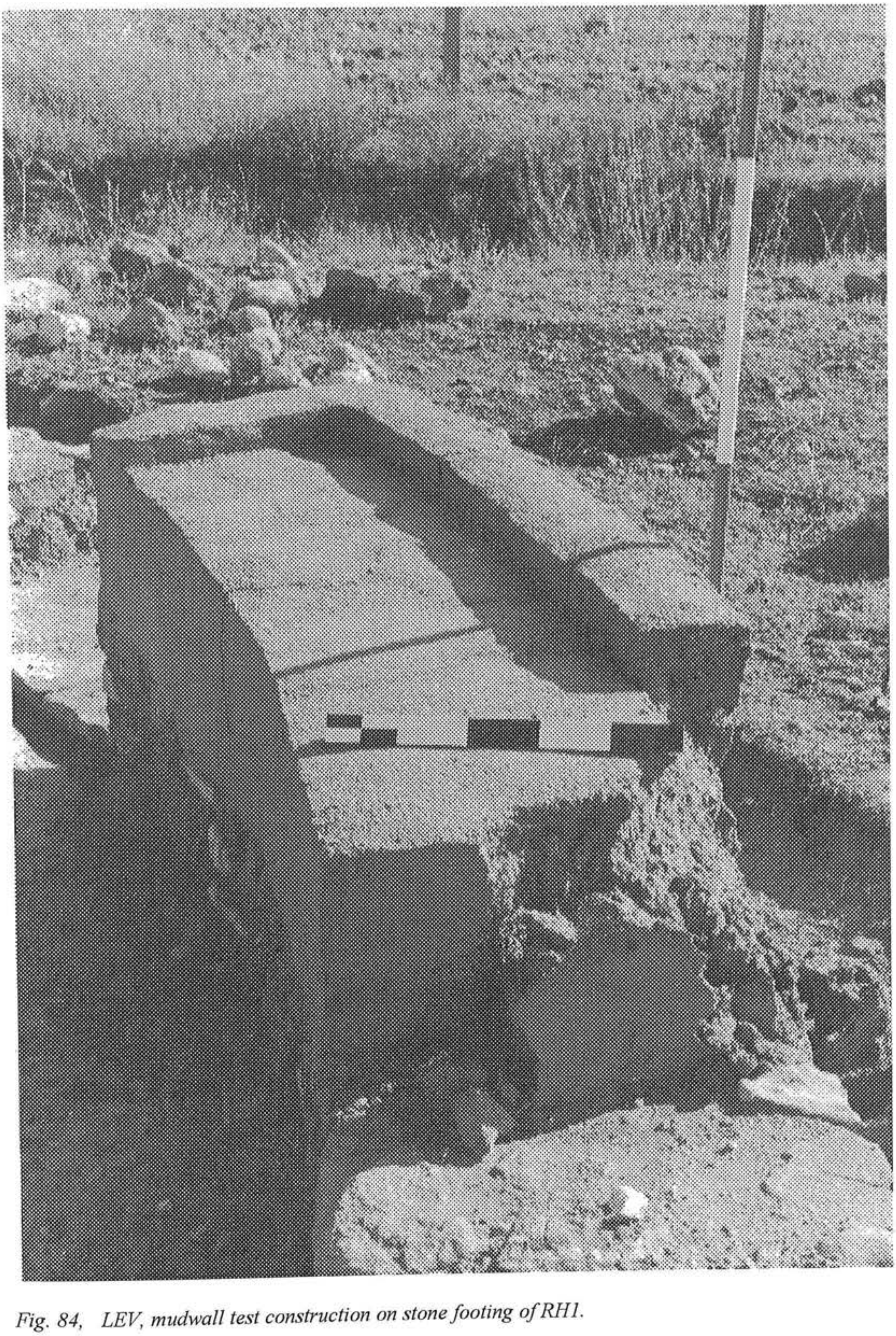


Fig. 84, LEV, mudwall test construction on stone footing of RH1.

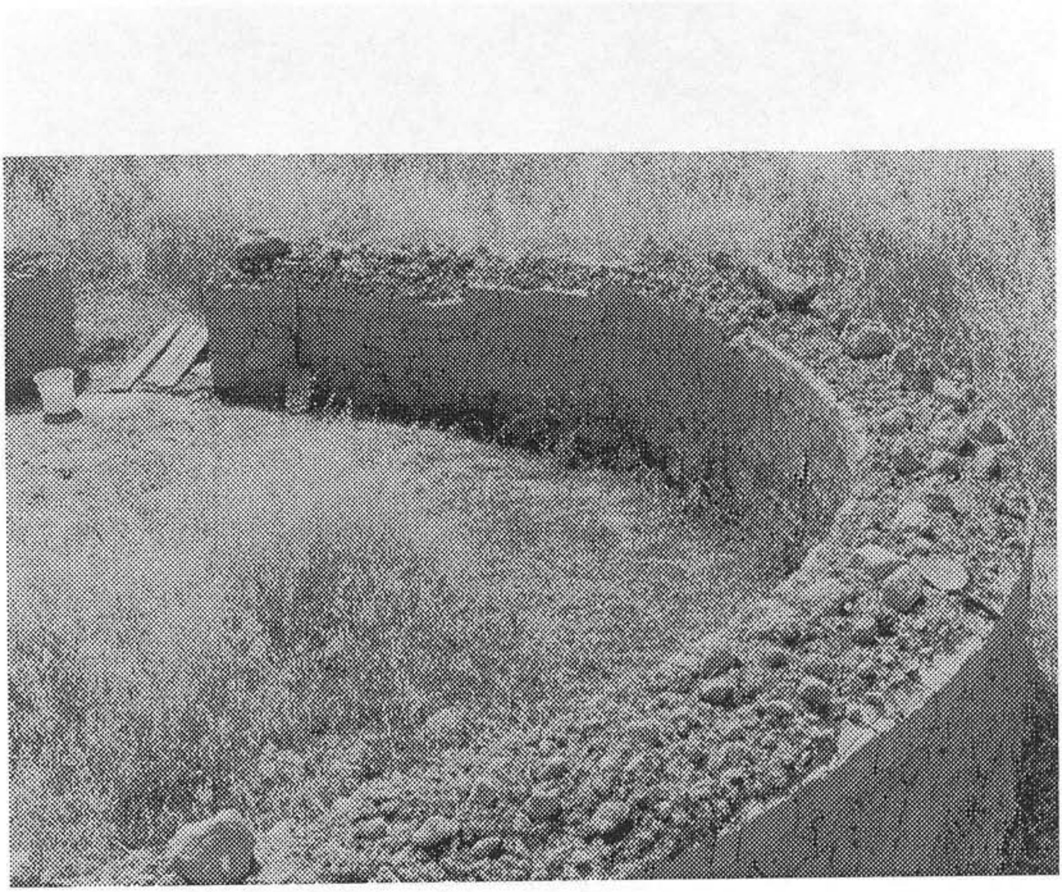


Fig. 85 LEV, RH1 mudwall construction showing block fractures and internal materials.

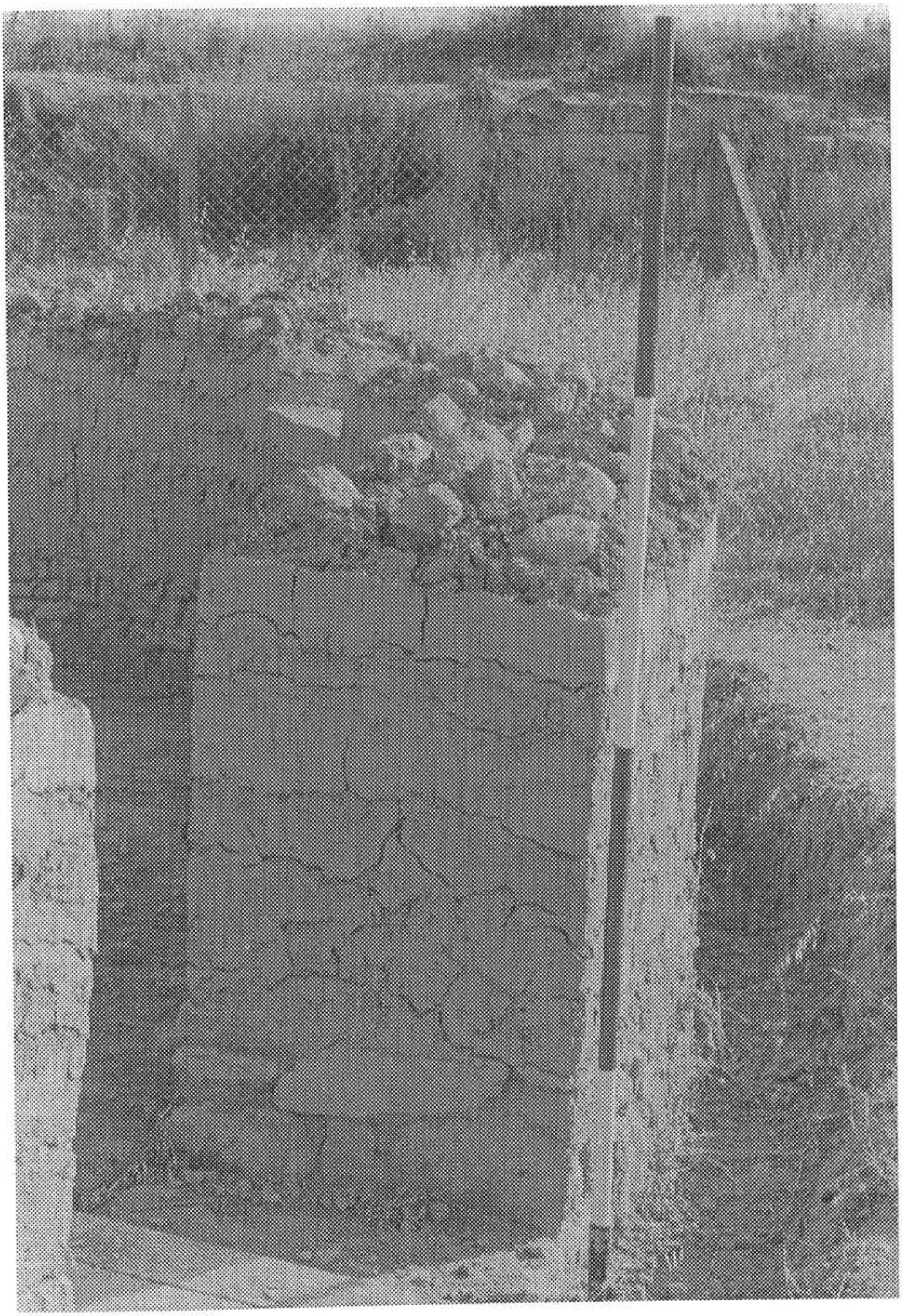


Fig. 86 LEV, RH1 view of door jamb and foundation cut.

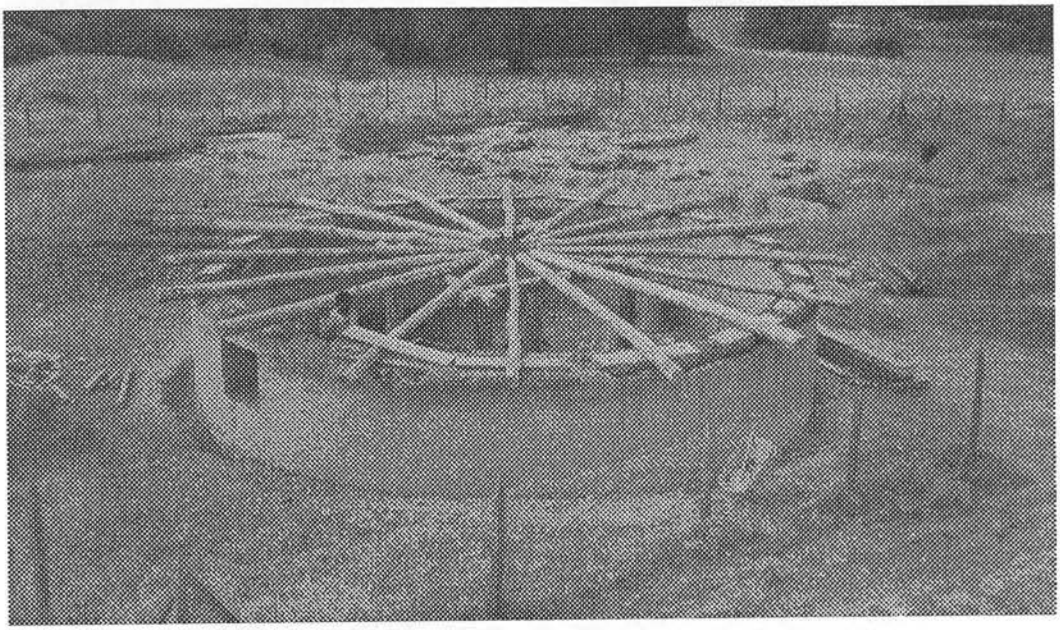


Fig. 87 LEV, RH1 from the NE with timber supports and radial rafters in place.

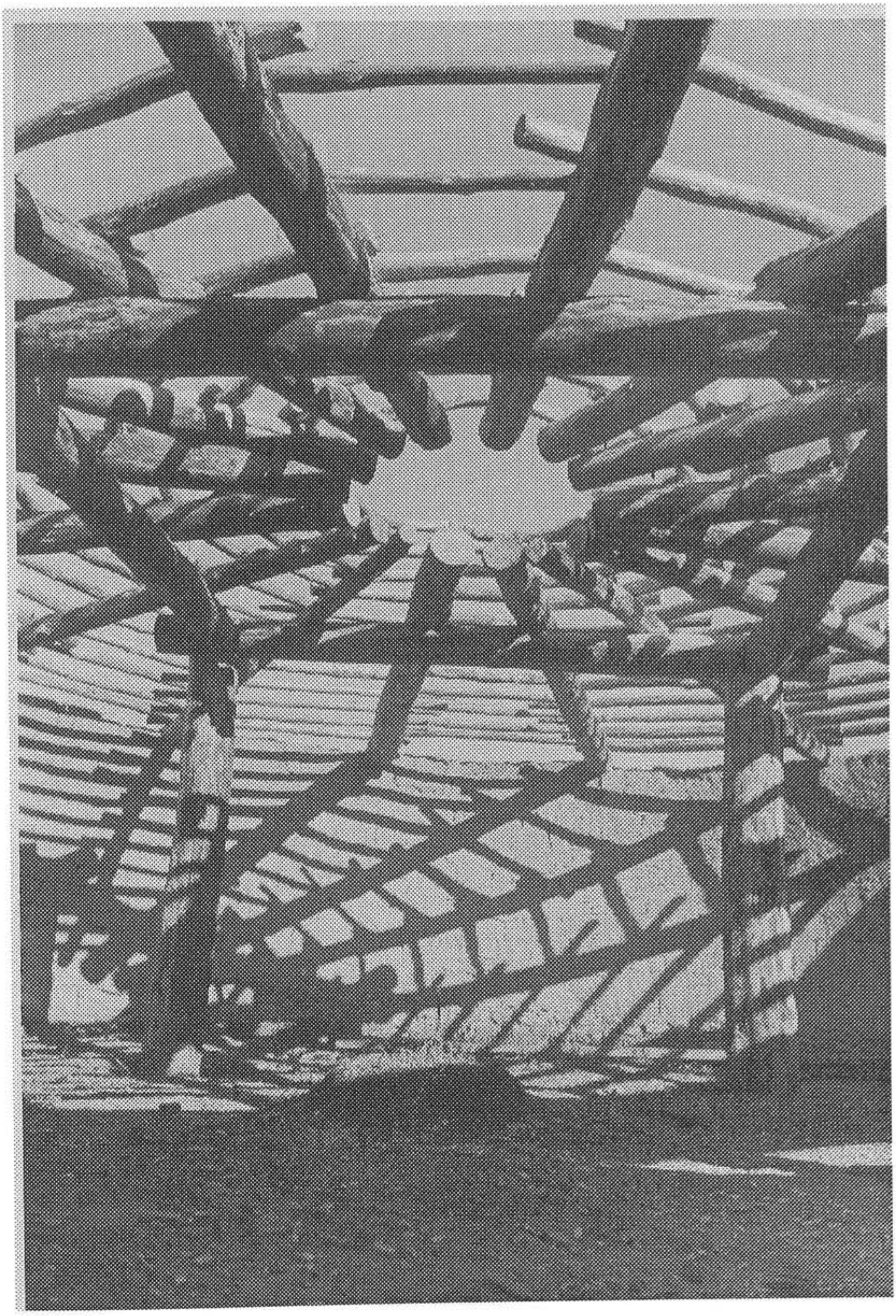


Fig. 88 LEV, RH1 interior view of roof timber arrangement.

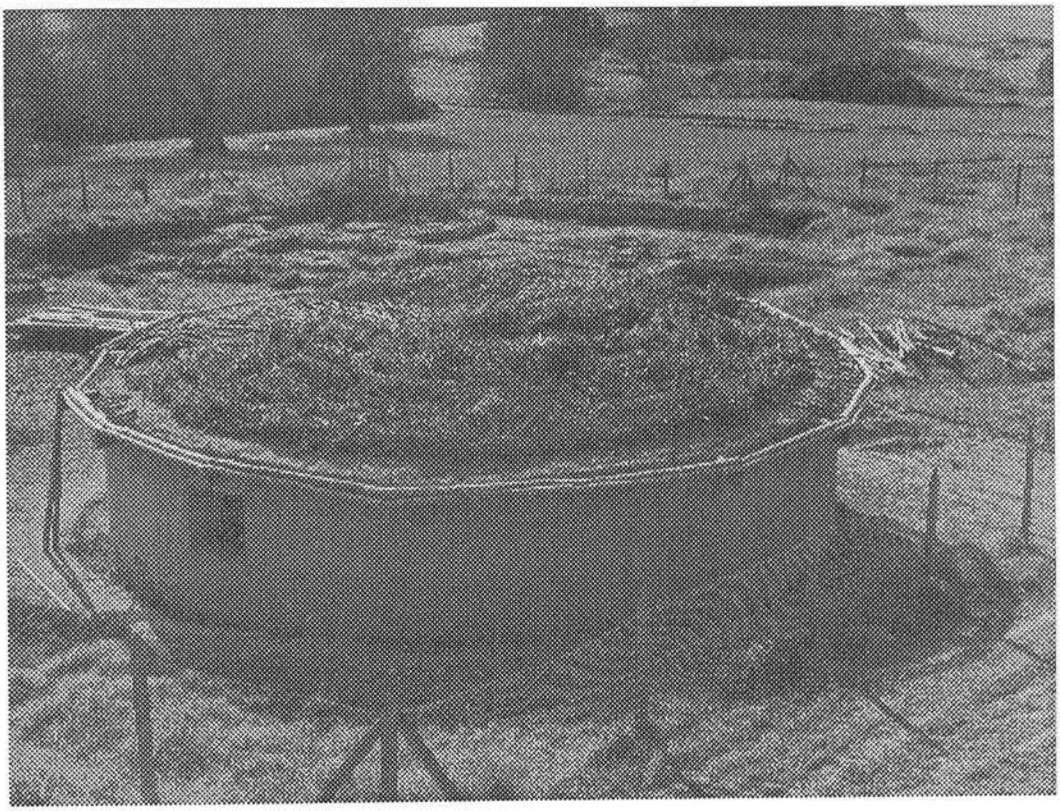


Fig. 89 LEV, RH1 from the E with the roof under construction.

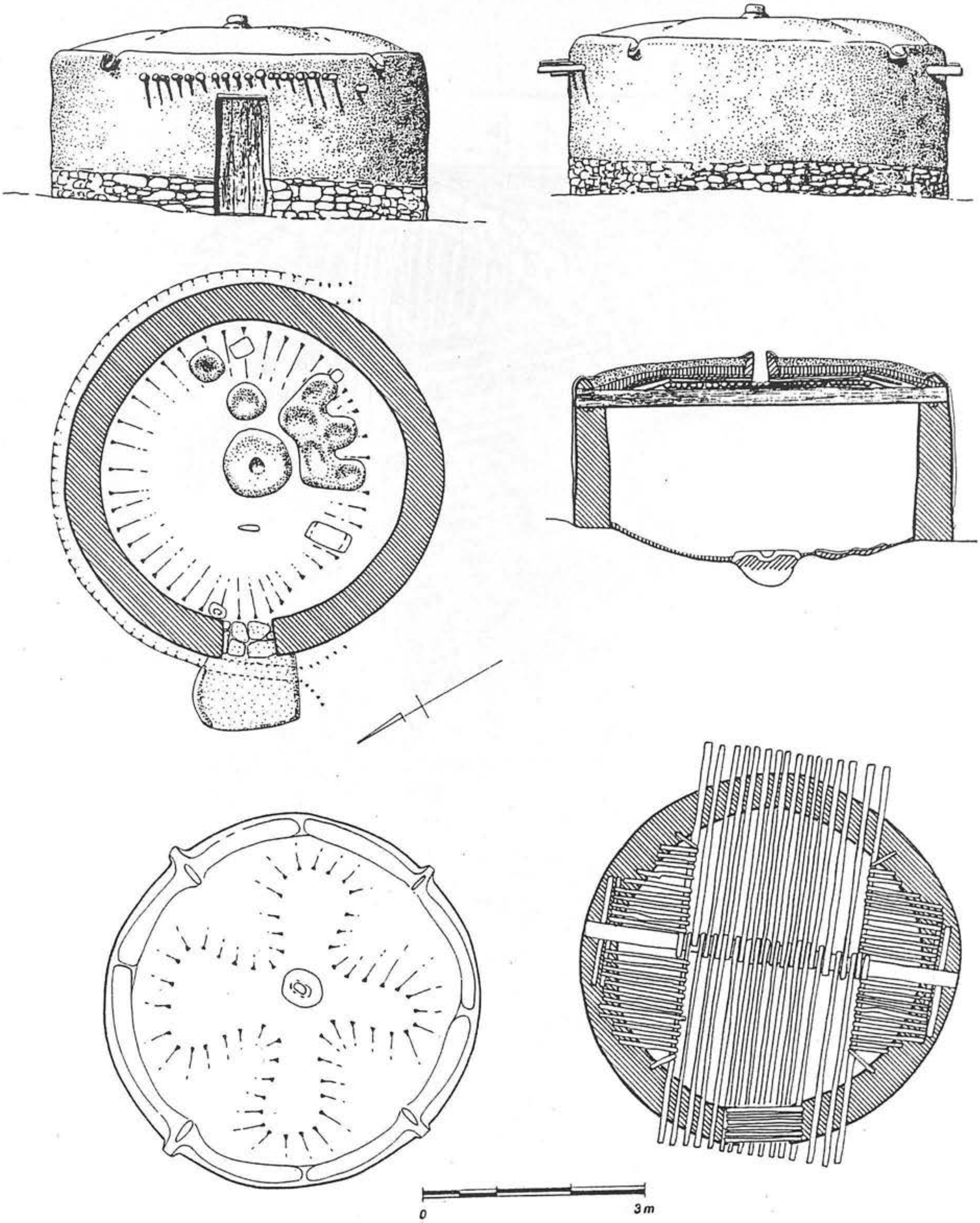


Fig. 90. LEV: RH2 plans and elevations.

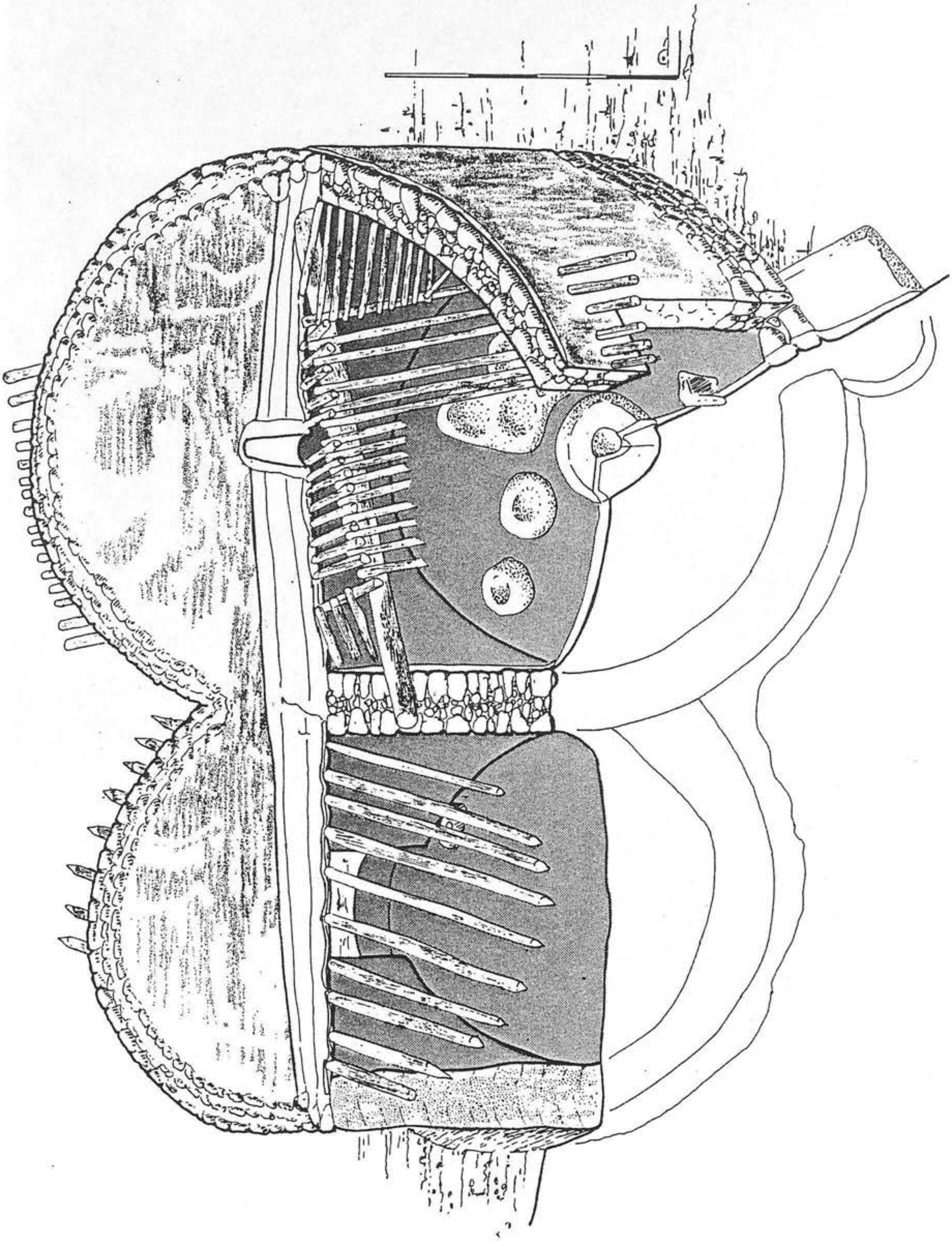


Fig. 91. LEV: RH2 and RH4 isometric view.

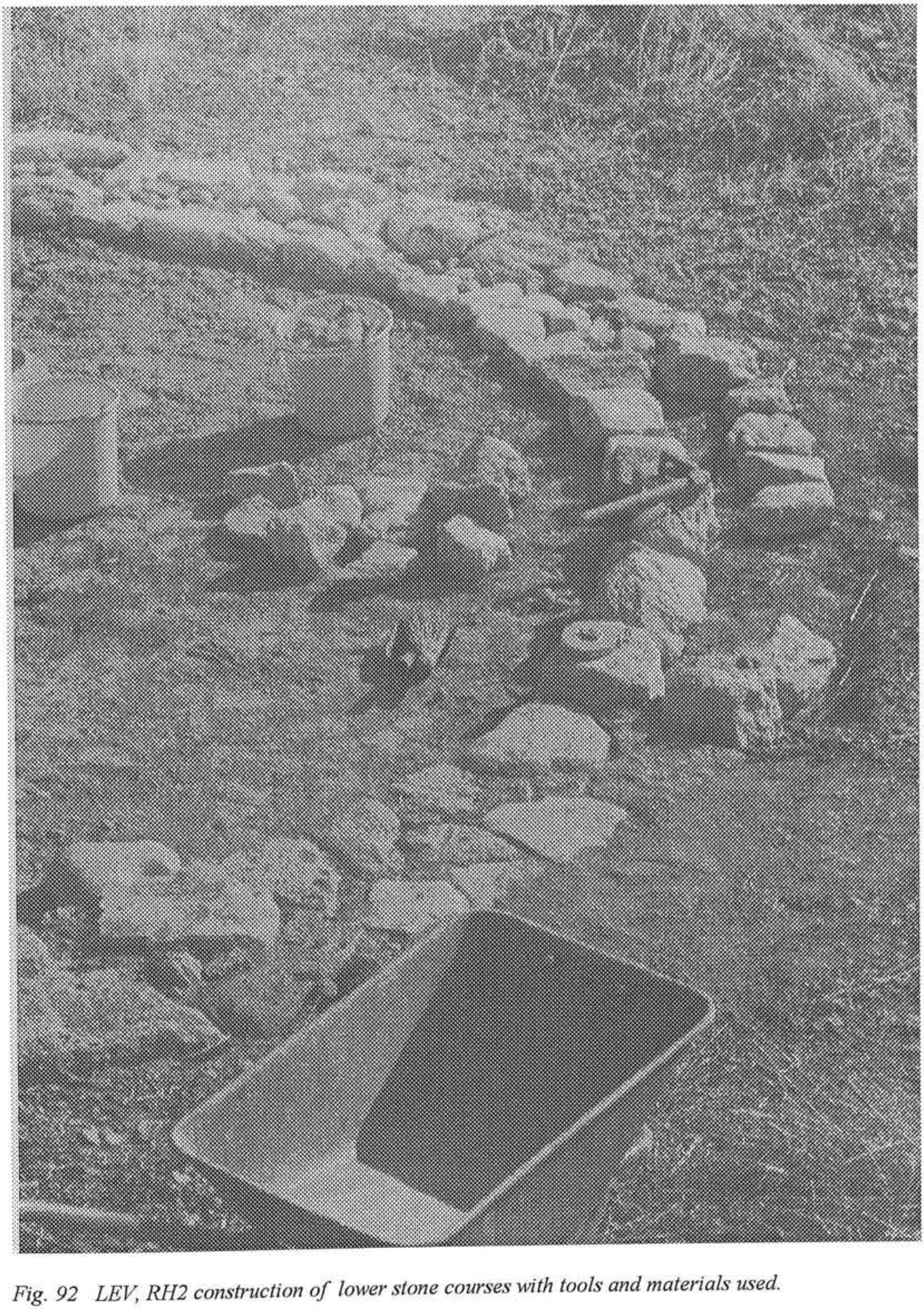


Fig. 92 LEV, RH2 construction of lower stone courses with tools and materials used.

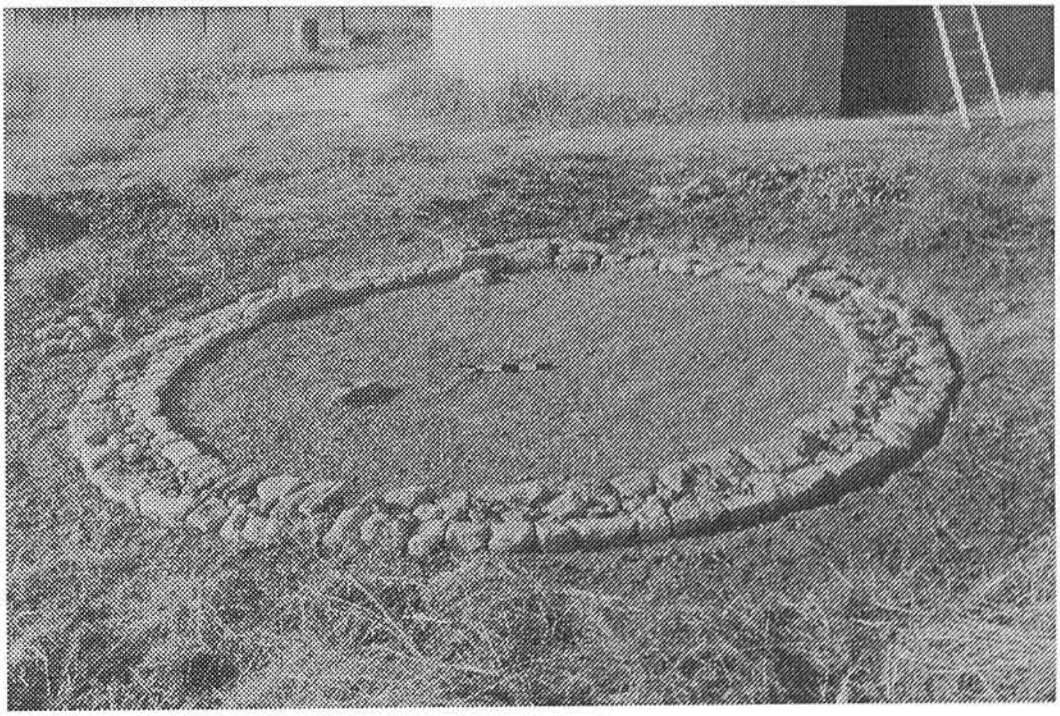


Fig. 93 LEV, RH2 foundation and lower stone courses.

Fig. 94 LEV, RH2 stonewall under construction.

Fig. 95 LEV, RH2 showing method of stonewall construction.

Fig. 96 LEV, RH2 stonewall construction showing the application of a thick mud mortar over the stones.

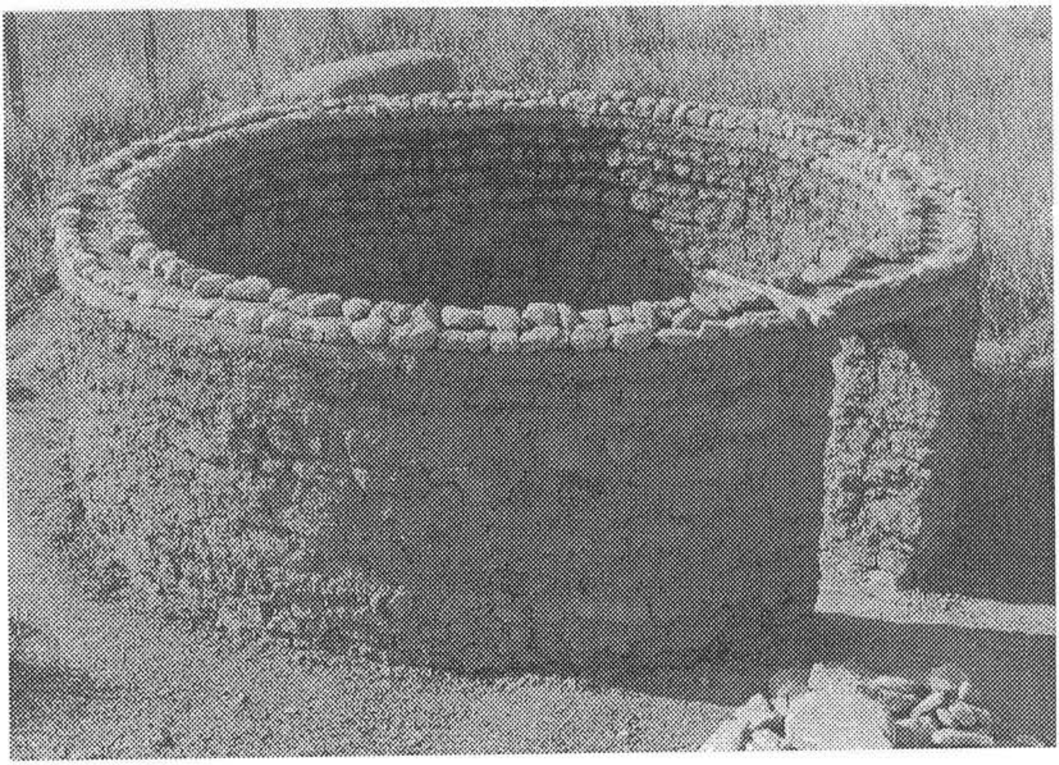


Fig. 97 LEV, RH2 stonewall nearing completion with door lintel and bracket in place.

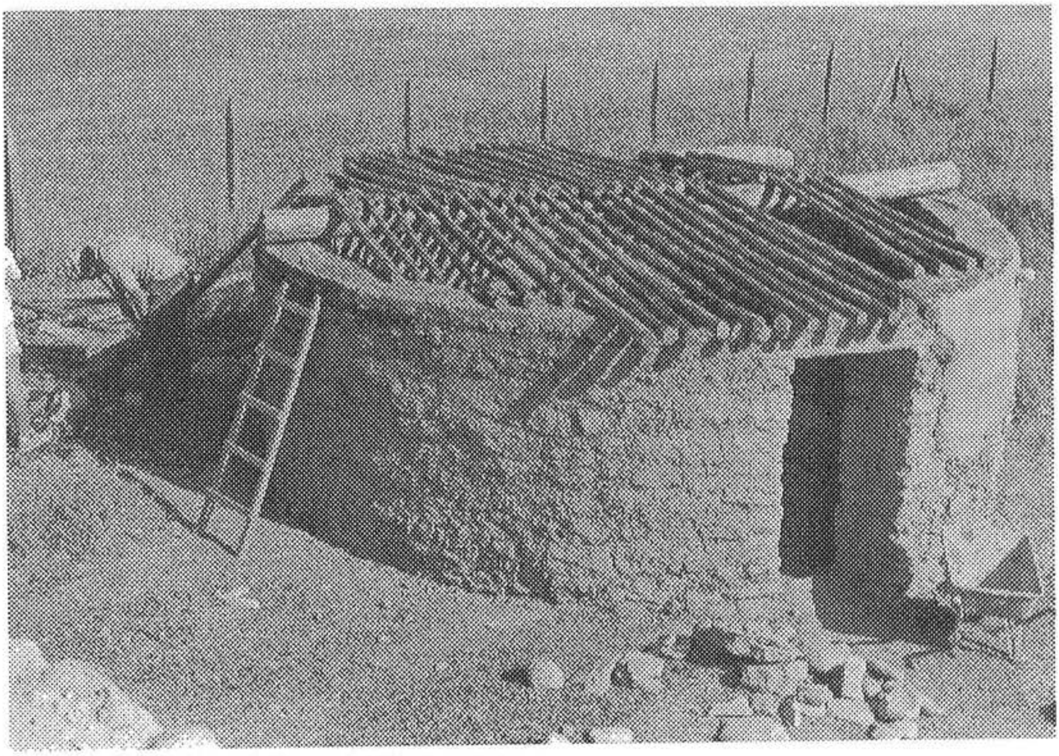


Fig. 98 LEV, RH2 ridge pole and rafters for roof being assembled.

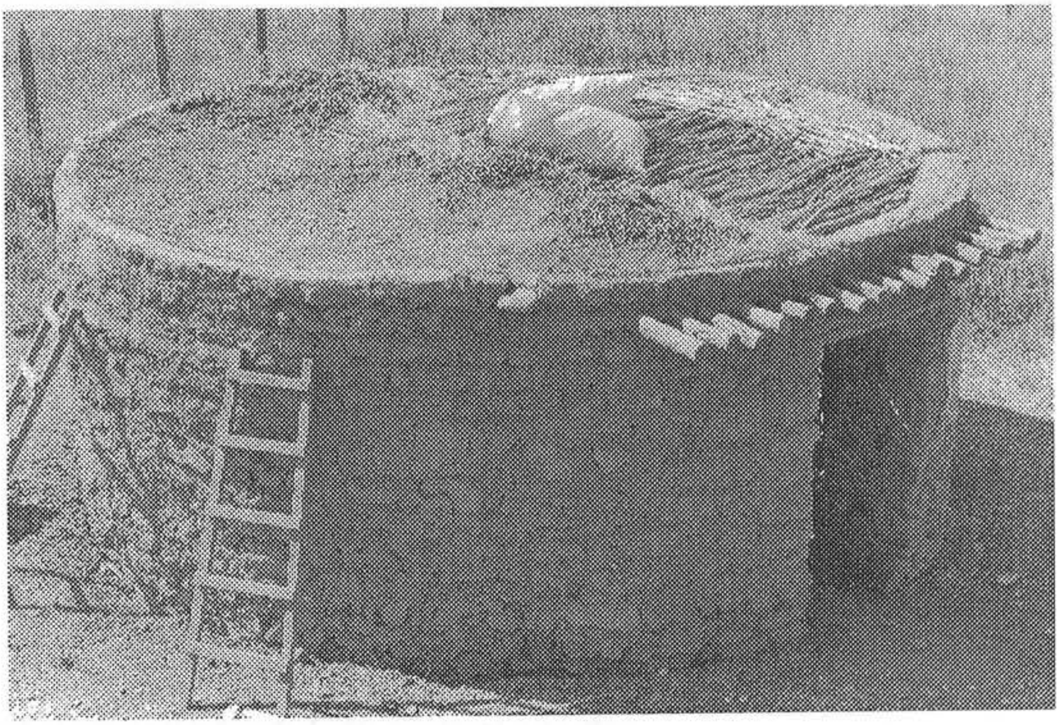


Fig. 99 LEV, RH2 with the roof under construction.

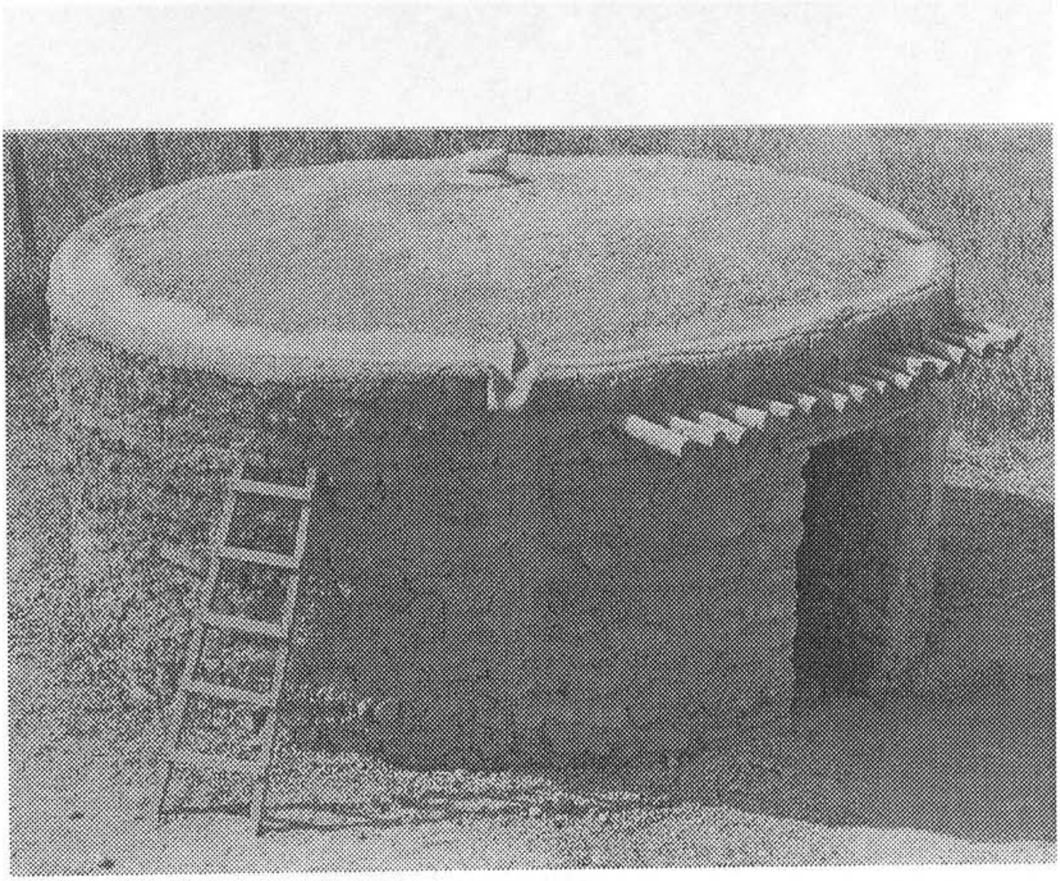


Fig. 100 LEV, RH2 completed structure before the application of the mud render. Note the roof gutters and drains.

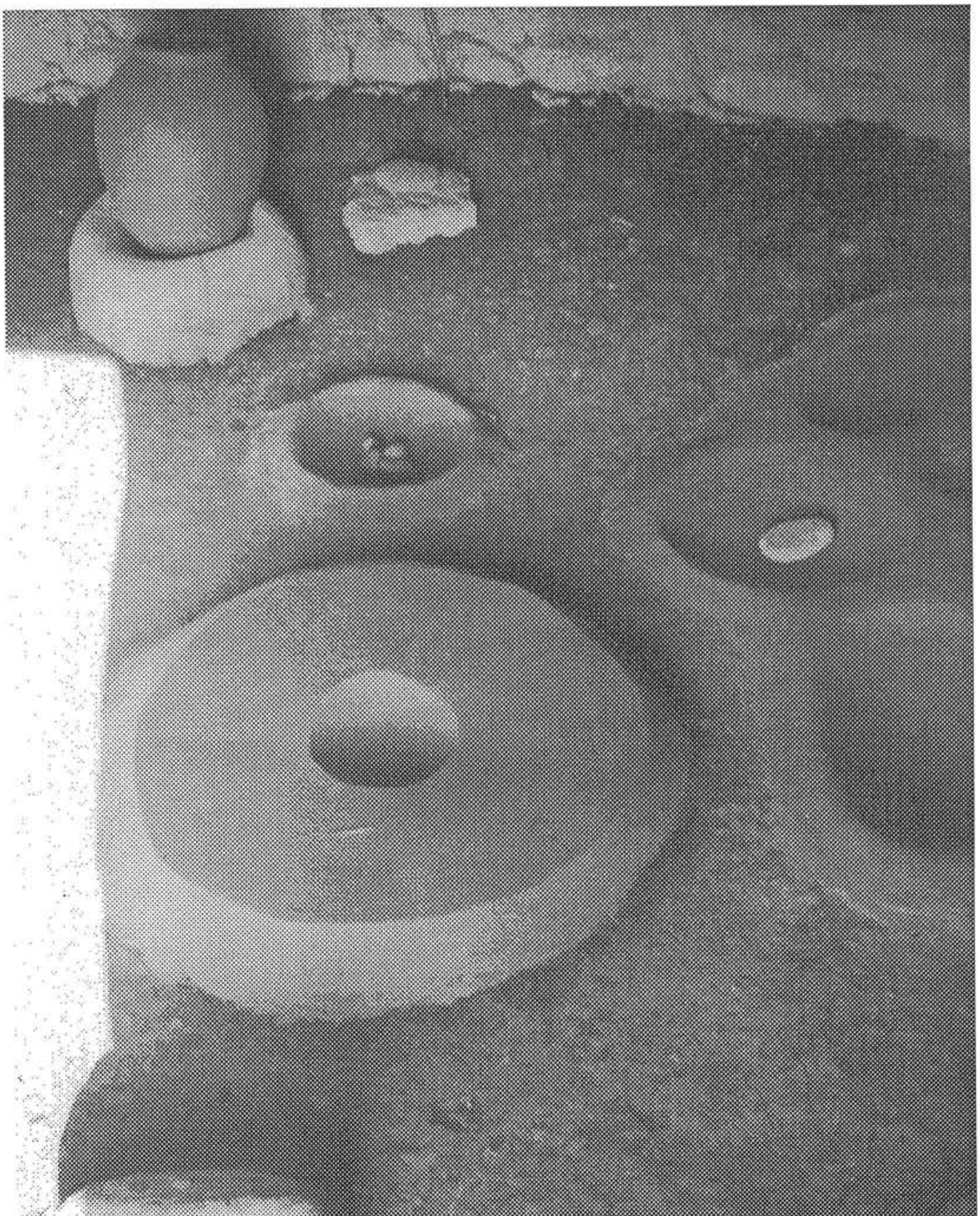


Fig. 101 LEV, RH2 internal fixtures showing the hearth at centre, the plaster basins to the right, the pot stand at the rear and the upright quernstone in the foreground before the hearth.

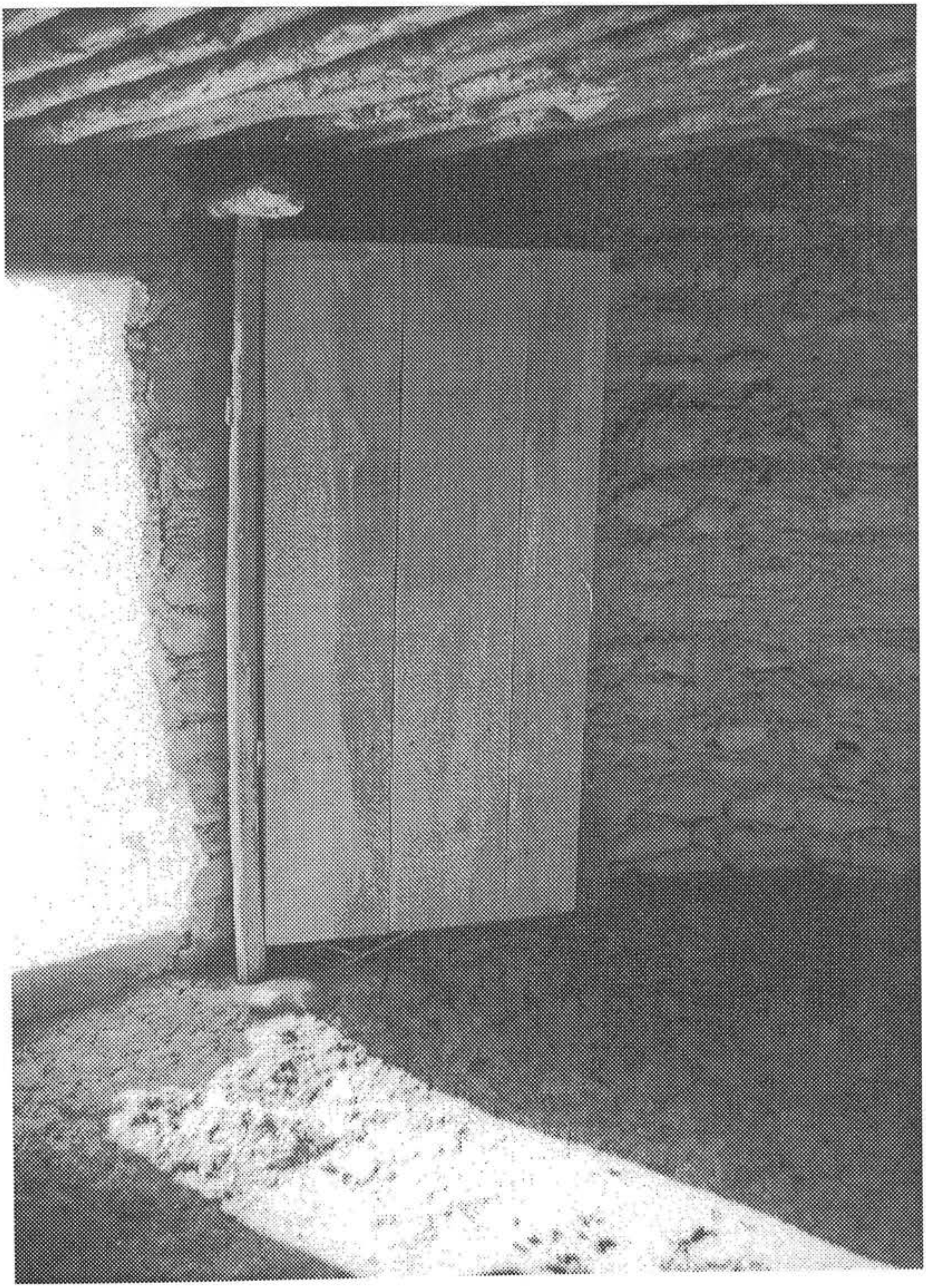


Fig. 102 LEV, RH2 the door.

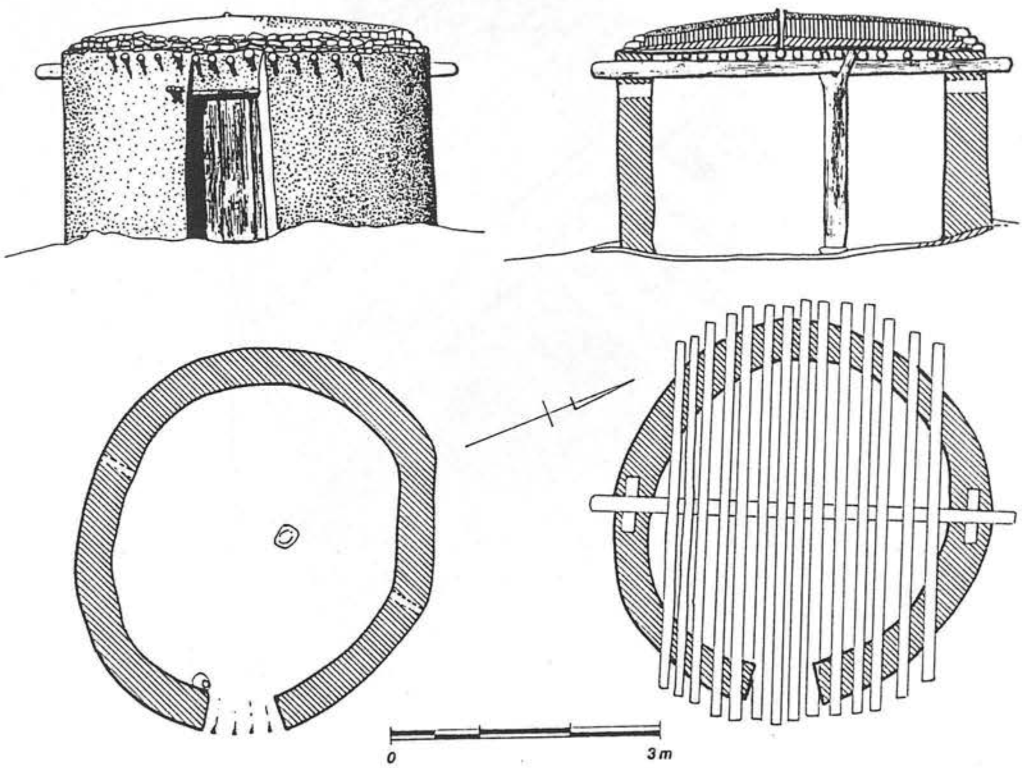


Fig. 103. LEV: RH3 plan and sections.

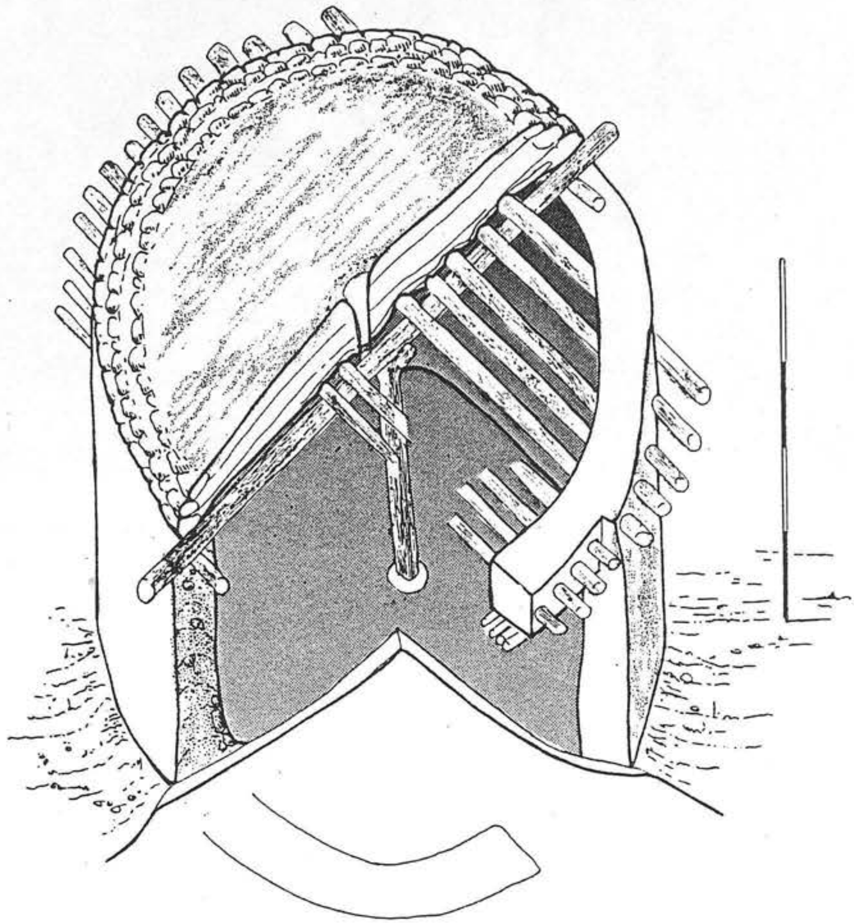


Fig. 104. LEV: RH3 isometric view.

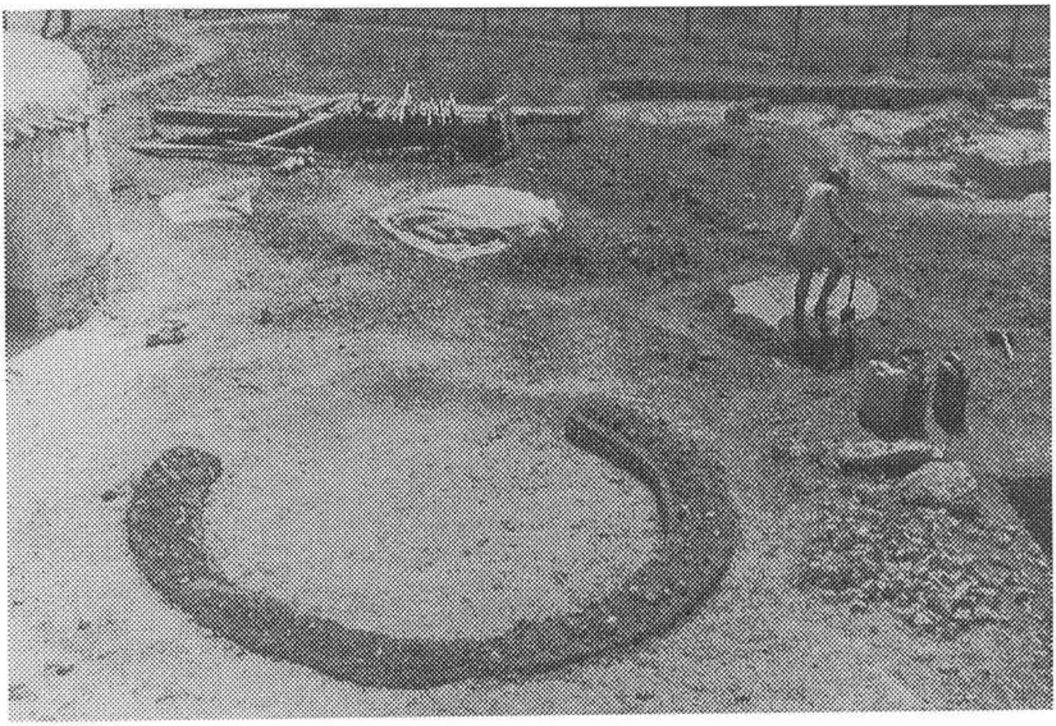


Fig. 105 LEV, RH3 foundation hollow and first mudwall courses.

Fig. 106 LEV, RH3 the mudwall under construction.

Fig. 107 LEV, RH3 the construction of the wall by hand.

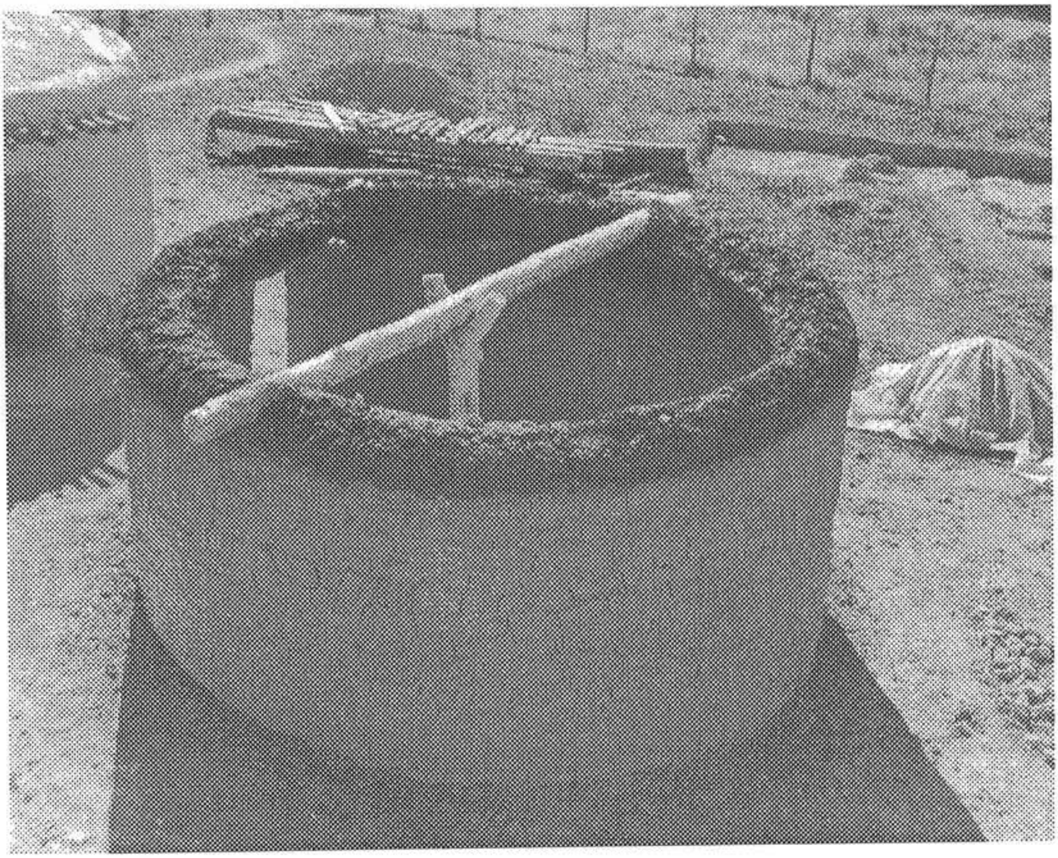


Fig. 108 LEV, RH3 the finished wall with the timber upright and ridge pole in place.

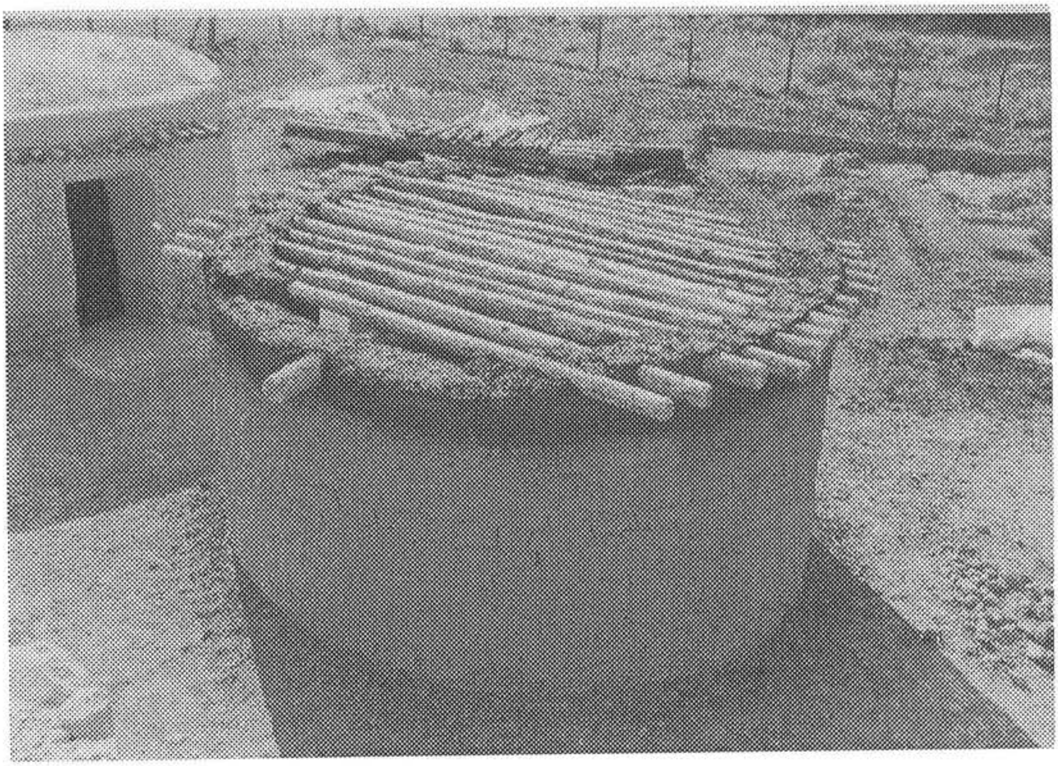


Fig. 109   LEV, RH3 with the rafters in position.

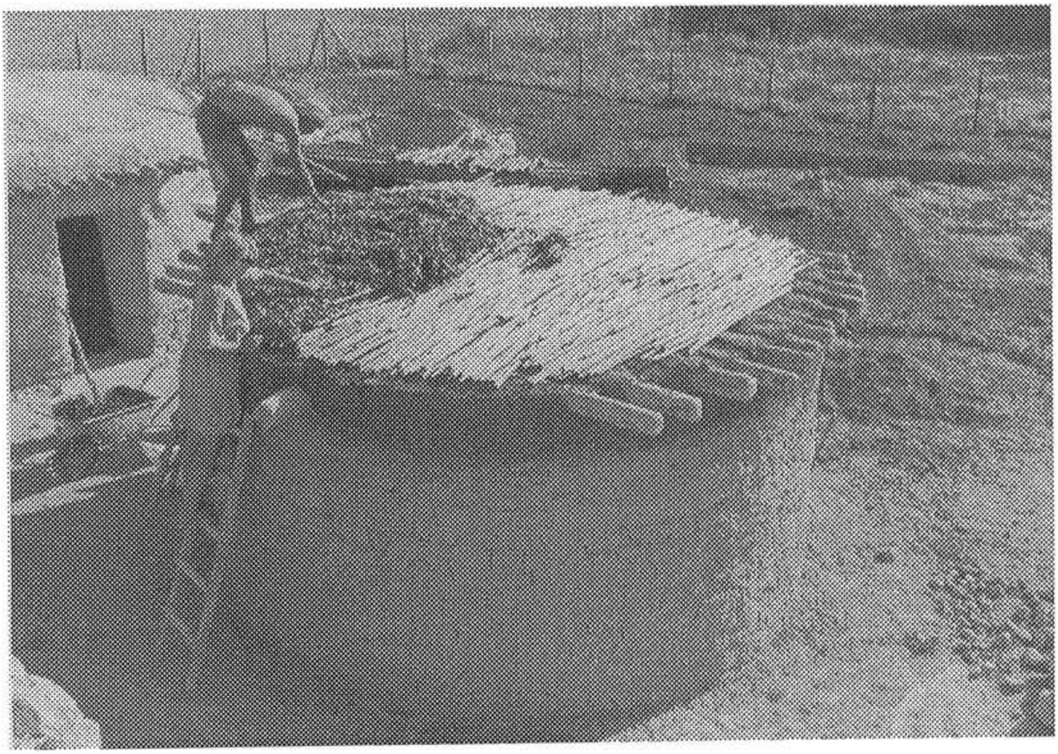


Fig. 110 LEV, RH3 placing the bamboo and seaweed on the roof.

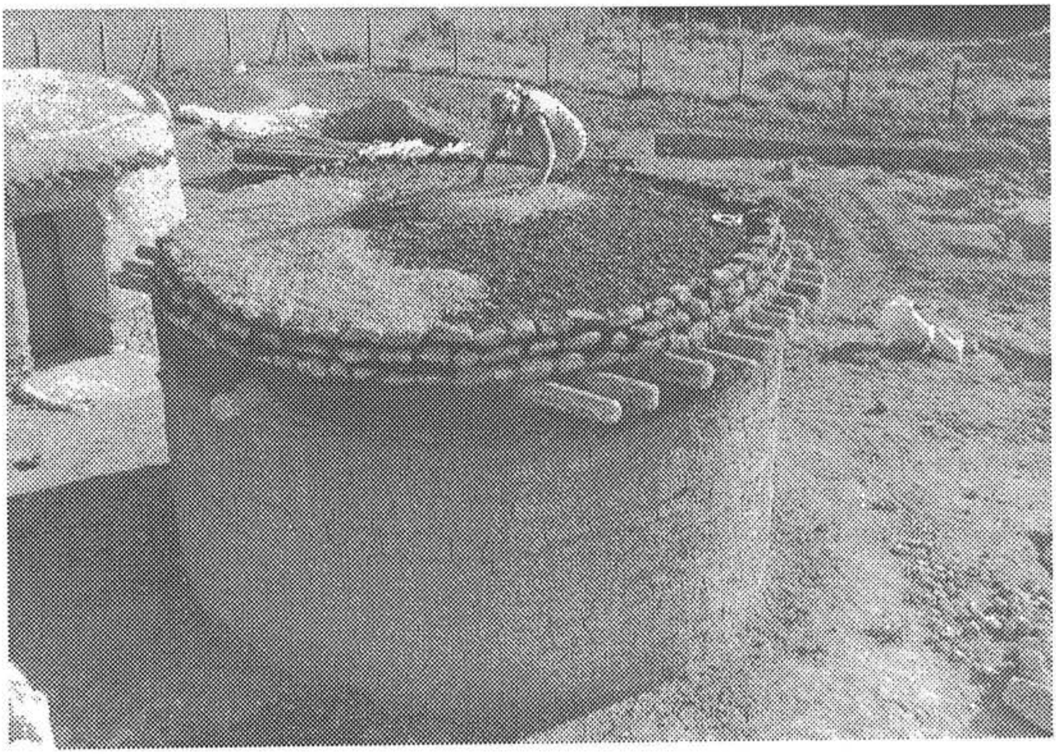


Fig. 111 LEV, RH3 spreading the final layer of havara on the roof.

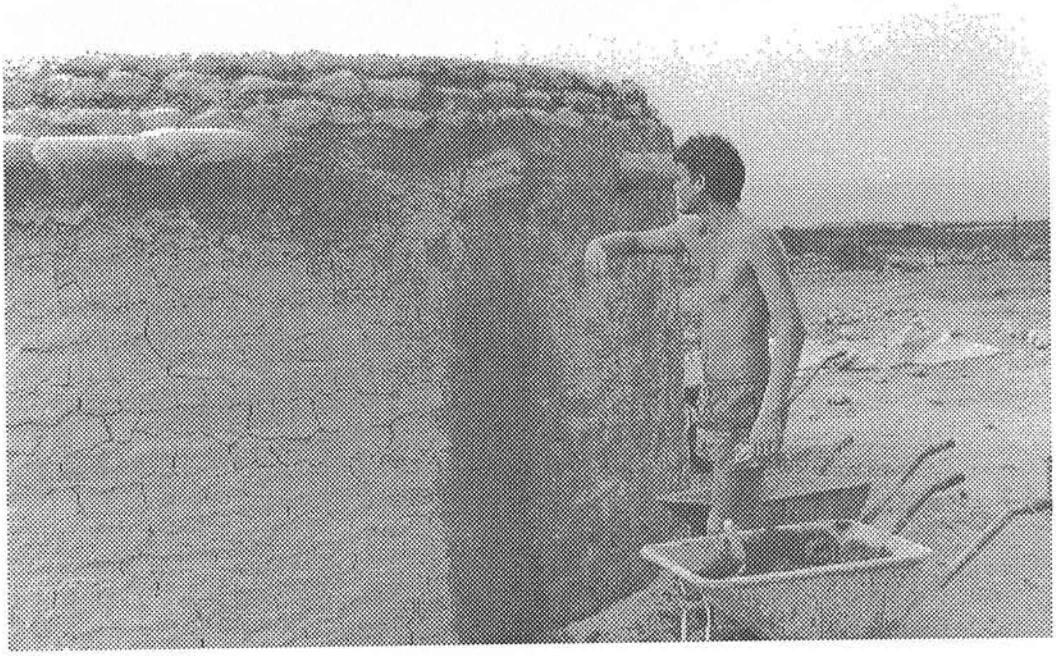


Fig. 112 LEV, RH3 application of havara dusting to render before burnishing.

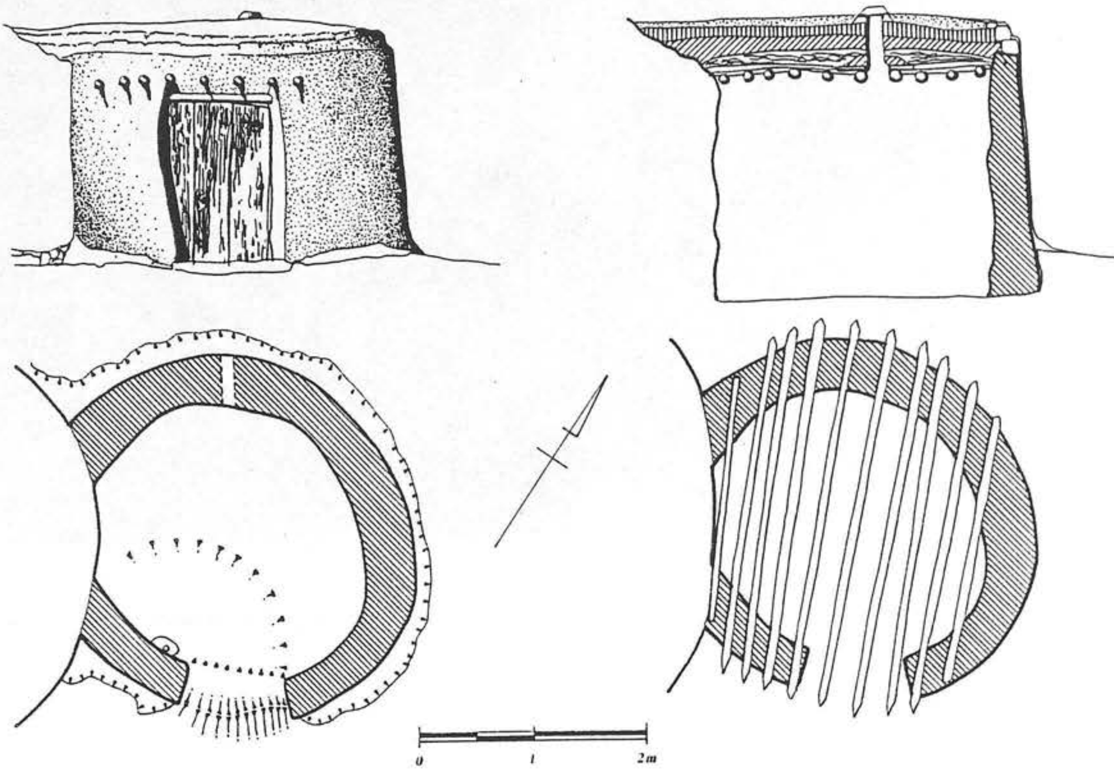


Fig. 113. LEV: RH4 plans and elevations.

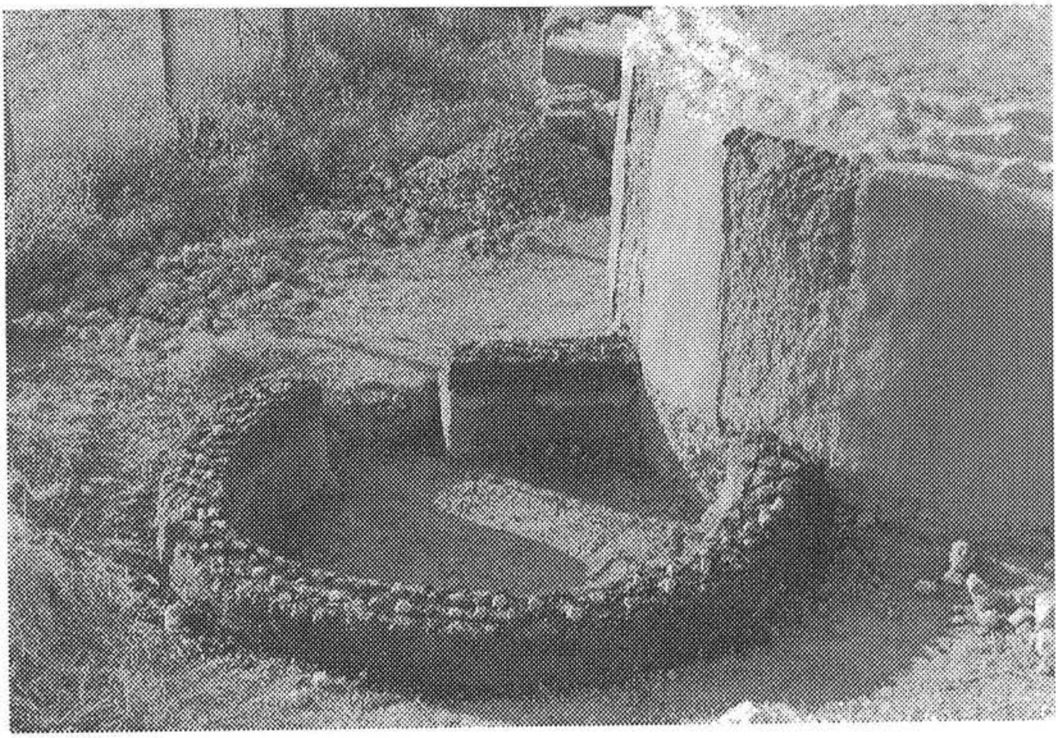


Fig. 114 LEV, RH4 foundation hollow and lower mudwall courses.

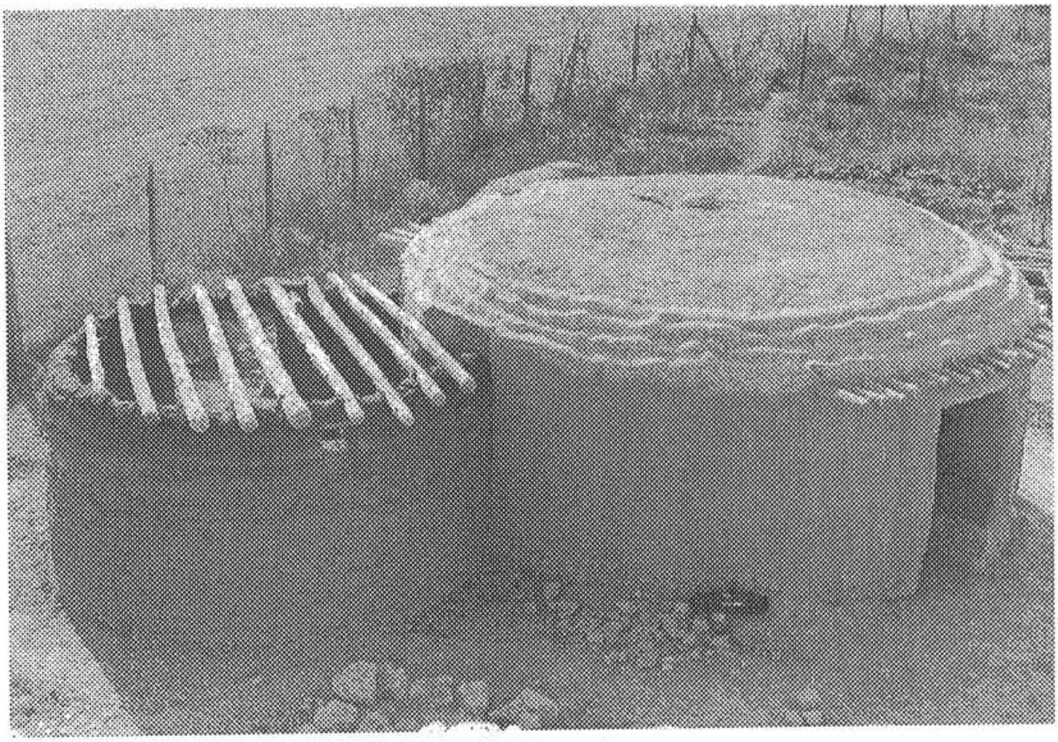


Fig. 115 LEV, RH4 with completed mudwall and rafters in position.

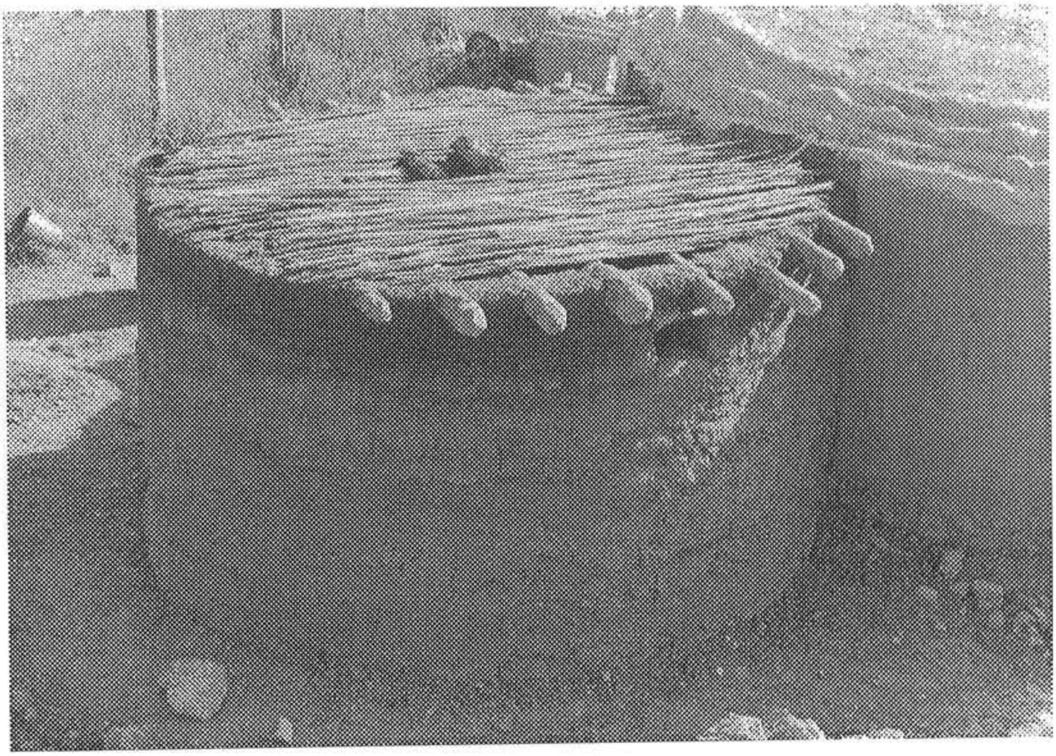


Fig. 116 LEV, RH4 roof with bamboo layer in place. Note the smokehole and window.

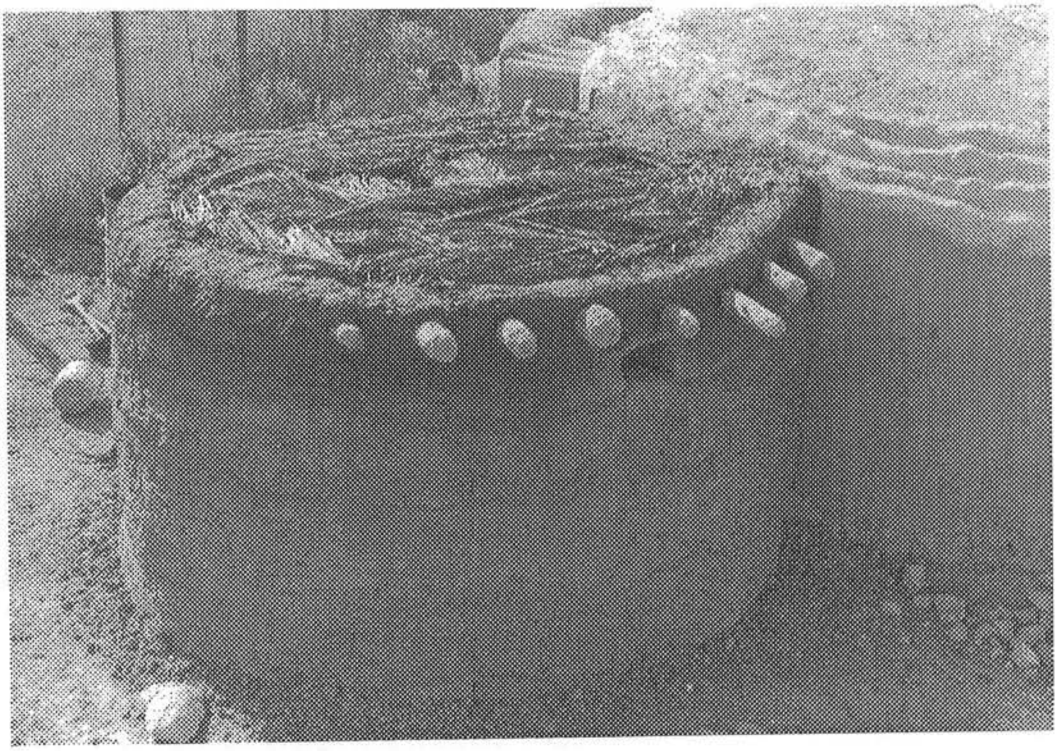


Fig. 117 LEV, RH4 roof with final mud course to secure rafters and palm fronds overlying bamboo.

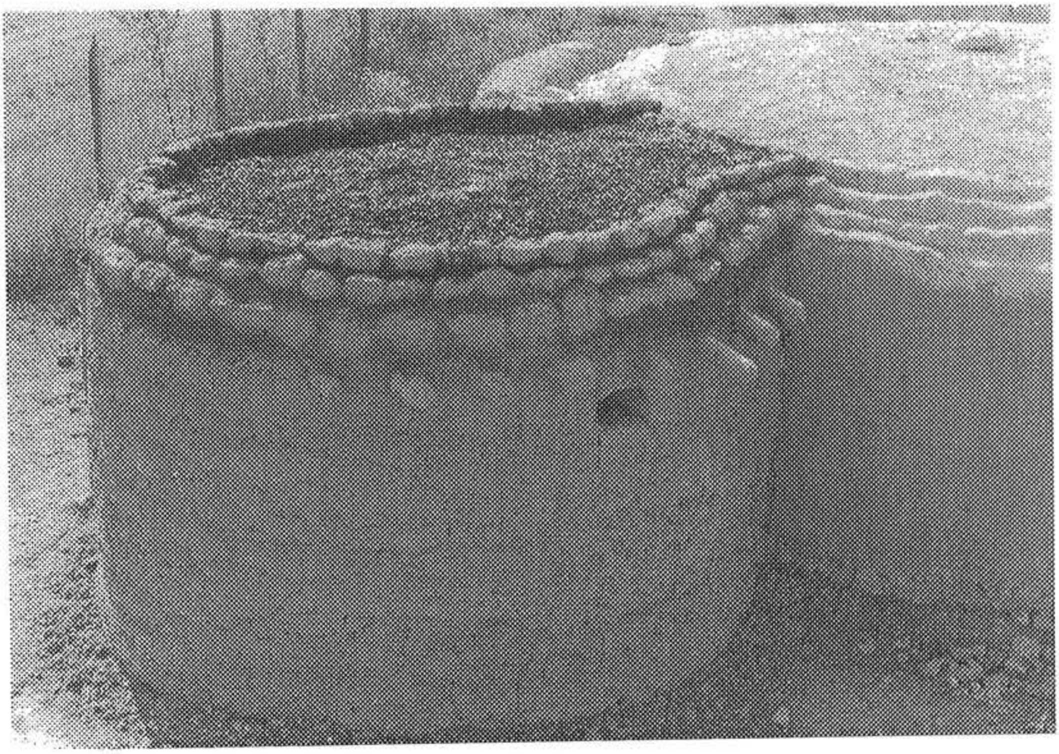


Fig. 118 LEV, RH4 the completed building before the application of the render and the final layer of havara an the roof.

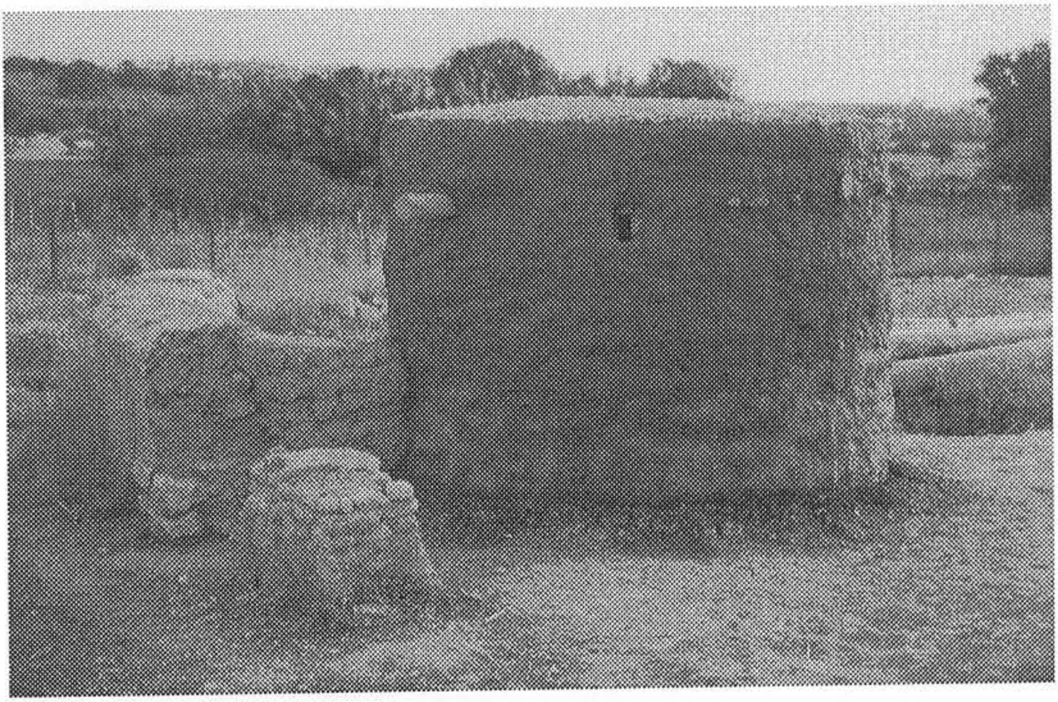


Fig. 119 LEV, RH5 and test walls viewed from the N.

Fig. 120 LEV, RH5 and burial experiment E36 viewed from the S.

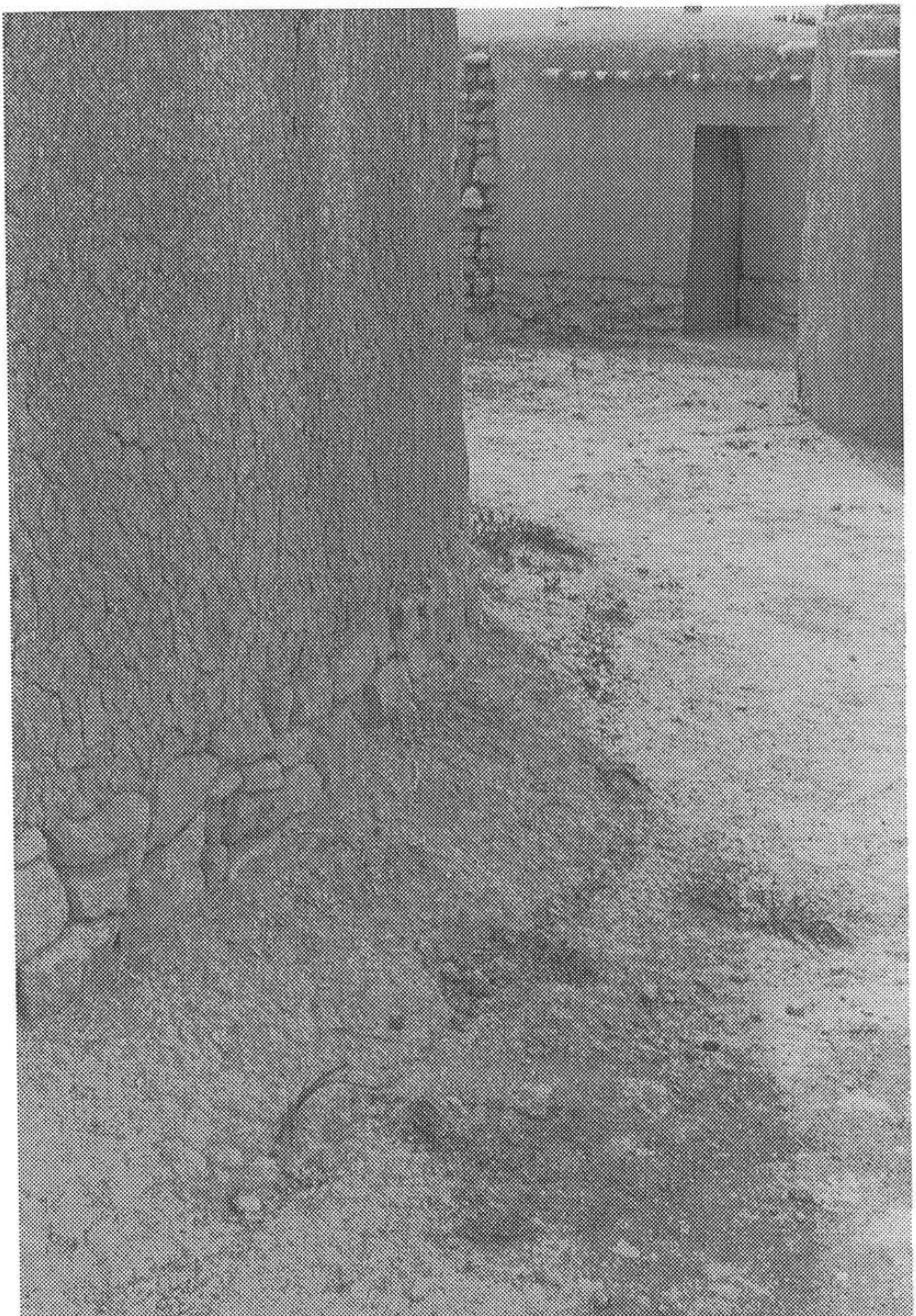
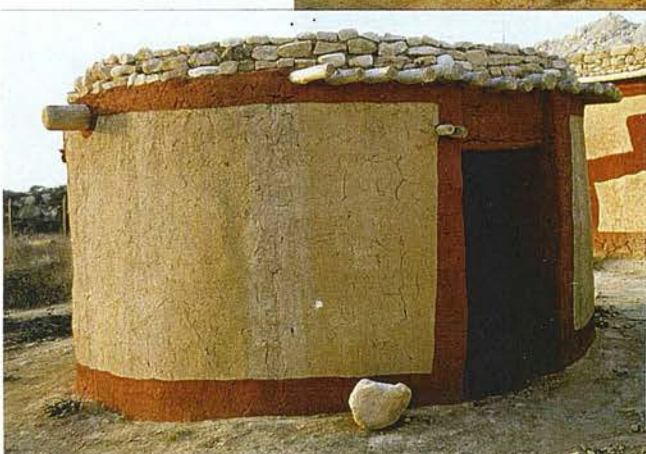


Fig. 121 LEV, view along the W side of RH1 showing the drip trench.

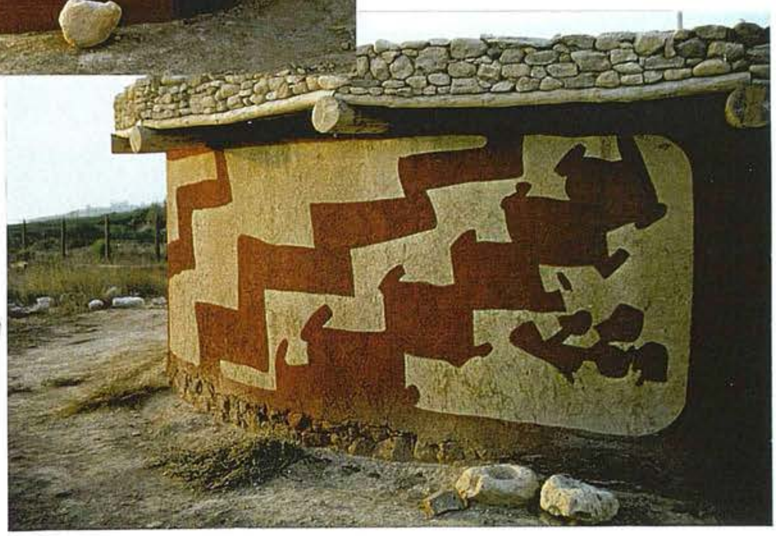
Fig. 122 LEV, 1994 view of RH1-3 showing winter damage.

RH2 and RH4
from the W.

RH2 from the S.



RH3 from the SE.



RH1 decoration.

Fig. 123. LEV, 1995 views of RH1-4.

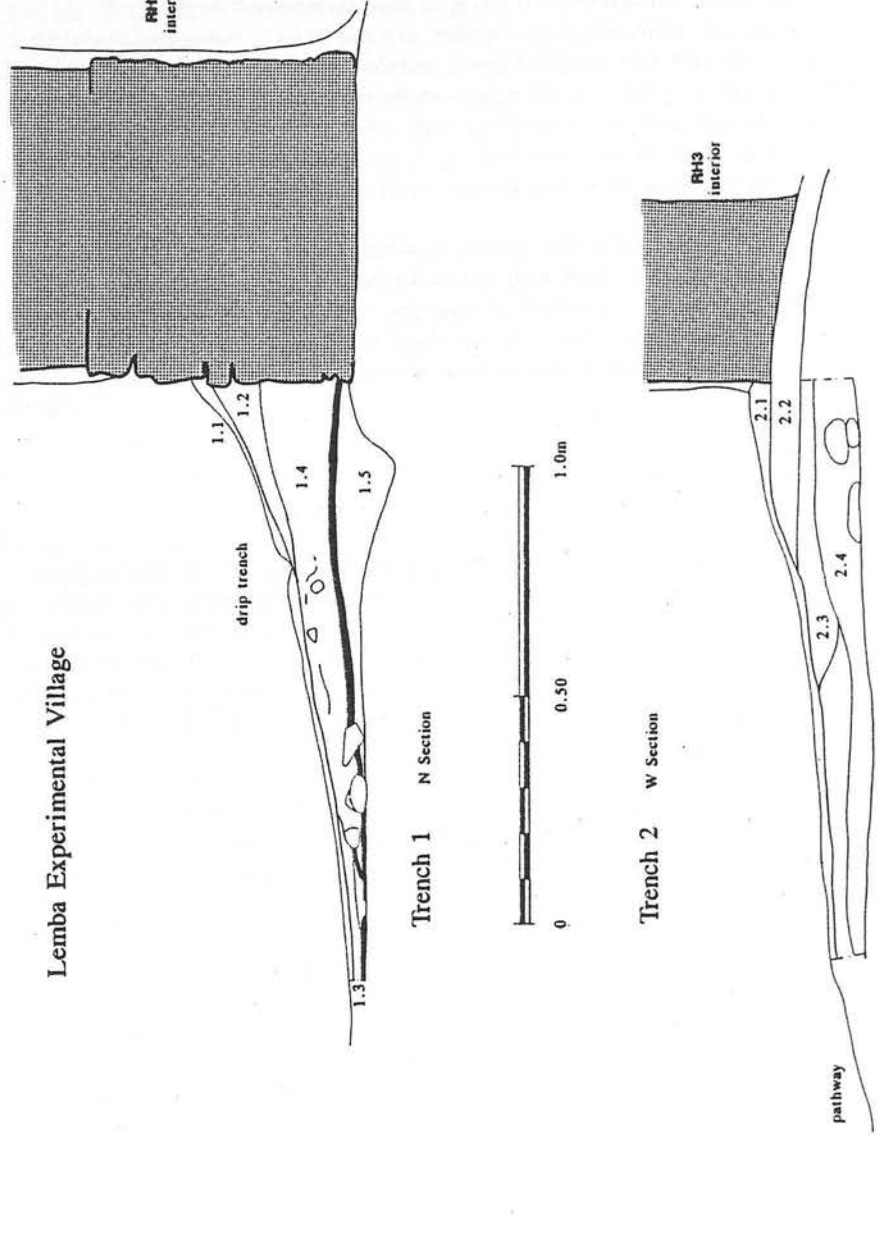


Fig. 125. LEV: sections of trenches T1 and T2.

Appendix 1:
Catalogue of Building Elements; Kissonerga Mosphilia.

The following catalogue is a brief description of all the elements associated with the buildings excavated from 1982 to 1993 at *Kissonerga* by the LAP under the direction of Prof. E.J.Peltenburg. Most of these buildings were either excavated by myself or were under excavation during my presence on the site as a supervisor and field director. Many of the descriptions, therefore, come from direct observation as well as from field notes. The classification was first developed during the excavations of the site of *Lemba* Lakkous (*LAP* 1) and were further refined or altered to accommodate the more extensive remains from *Kissonerga*. This final classification and description of the various elements has emerged from my own study of the materials used in prehistory and has also drawn on other sites to provide a complete documentation of all known Chalcolithic building features. The main sites used in the classification system are Kissonerga *Mylouthkia*, *Lemba* Lakkous and *Kissonerga* Mosphilia. Reference is also made to other Erimi Culture sites where similar elements are to be found but the date of publication of these sites considerably diminishes their usefulness for a detailed understanding of materials and construction methods. These sites are *Erimi* itself and *Kythrea*, both of which will be included in any discussion where they have produced suitably preserved examples of a particular building element.

The format of the catalogue is straightforward starting with a line of information on unit number, associated building, period and type. This is followed by a brief description and any relevant measurements and finally, associated small finds, and sample numbers. In this section, for ease of reference, all archaeological units are indicated in **bold** and all small find and sample numbers are indicated by <u>underlining</u>. All entries have been sorted by number apart from entrances which are sorted by building number.

A1.1 Walls.

9. B1, Period 4, Type 2.

Badly damaged bank of mud and stones max 0.20m high. Friable, hard reddish/brown mud with stones and cobbles laid in an irregular fashion. Missing to N and W. Wall is set on the edge of a broad type 1 foundation scoop and the inner wall face has been finished in a type 3 clay havara render which curves down to the floor. Ten postholes are located around the perimetre of the wall: **22** (0.45 x 0.25m); **23** (0.20 x 0.40m, irregular shape); **223** (0.30 x 0.25m); **241** (0.19 x 0.18m, vertical cut); **247** (0.22 x 0.26m, vertical cut); **248** (0.80 x 0.08m, vertical cut); **249** (0.13 x 0.12m, vertical cut).

The wall contains a number of artefacts: <u>KM331</u>, chalk conical stone; <u>KM335</u>, pounder/grinder in diabase; <u>KM336</u>, pounder/grinder in microgabbro; <u>KM344</u>, diabase polisher; <u>KM367</u>, adze in pyroxene andesite; <u>KM368</u> cupped stone in reef limestone; <u>KM381</u>, hamer/grinder indiabase; <u>KM400</u>, RW spouted vessel. This latter small find was found smashed in a very localised situation on the SE arc of the wall and may have been deliberately included.

29. B4, Period 3b, Type 3.

A well-built wall with a stone base and mud superstructure 0.64m wide x 0.14m high. Stones are medium sized with good flat faces providing a regular inner and outer wall face with a rubble core of small irregular pebbles/stones set in mud. 1-2 courses survive. Patches of harder mudwall survive over the E arc of the SE arc of the wall. Only the E half of the building survives having been removed to the W by later buildings. The S end of the wall appears to be set with facing stones forming a squared and finished edge which may represent the E terminal of an entrance way. There is a short stretch of wall at its intersection with radial ridge **304** where no stones appear. This may be the result of the loss of these stones through erosion or robbing rather than being a section deliberately constructed solely in mud. Set in a type 2 foundation, **1696**, with an exterior ring of stones lying at the wall base, **388**.

Contains several small finds including a cupped stone, <u>KM5035</u>, and a rubber.

34. B2, Period 3b, Type 3.

Well-built stone wall base c0.43-0.50m wide and standing max 2-3 courses, c0.41m high. It has an inner and outer face of large stones with flat edges set to the exterior, max 0.35-0.40m long, and is packed with a rubble core of small rounded stones/cobbles. This rubble core is best preserved in the SE arc of the wall. The stones on the basal course are, on average, slightly smaller than those above. It is bonded with a brown compact mud mortar (sample S260) which also overlies the stone courses and most probably represents the mudwall superstructre. The circuit of the wall is complete and shows a slight flattening of the circle in the NW and in the SE there is a discontinuity in the line of the stone footing. It is also noticeable at this point that the plaster floor, **389/2157**, does not bond with the wall. No interior wall finish was recorded although the lime plaster floor in the NW of the building, **131/2158**, does rise up along the wall base in a fashion similar to other walls which have been plastered. The wall is set into a deeply cut type 2 foundation terraced into a gentle slope to the E with an exterior ring of stones and cobbles, **388**, which survives along parts of the NW arc of the building. The W and S arcs of wall are not set into a terraced cut but directly onto the ground surface. A gap in the S arc of the wall may indicate the position of an entrance and the E end of the wall at that point is fairly well finished with two stones set across the wallwidth forming a possible E door jamb.

A stone phallus, KM340, of fine reef silicified chalk comes from within the SE arc of the wall.

46. B3, Period 4, Type 4.

A well-built stone wall with a mud mortar c0.50-0.60m wide and standing, in places, 7 courses high, c.78m. It is constructed of smallish stones/cobbles c0.10-0.25m long set roughly with an inner and outer face and core of mud and stones. The core is not always evident and there appear to be parts of the wall where only facing stones form the wall. There is quite a high mud content to the wall indicating it is not a dry stone construction with mud forming c30-40% of the bulk of the wall. There are stretches in which larger stones are used with the largest facing stones, c0.45m long, being used on the outer face. The interior wall face has been finished in a type 3 clay havara render, **737**. A massively constructed type 2 foundation cut, **392**, terraces the building on its N half into the steeply sloping hillside. In places, a row of up to 2 courses of stones survive as a ring at the base of the exterior ofthe wall. An entrance way, **606/7**, pierces the wall in the SW where threshhold paving and the E doorjamb survive.

Small finds discovered within the structure of the wall include:KM2641, KM2642, KM2645, KM2646, KM2649, KM2650, KM2653, KM2654.

47. Abuts **B3**, Period 4, Type 4?.

A stone built wall base 0.85-0.90m wide surviving 1 course, 0.18m, high. It is built of large blocks to form an inner and outer face with rubble core of cobbles. A discontinuous row of stones along the S face forms an outer layer/footing.

Small finds from the wall include: KM818, rubber/hammer; KM812, pounder; KM845, pounder.

73. B96, Period 4, Type 4?.

Poorly built wall of stones and mud c0.36m wide and surviving 1-2 course, 0.10m, high. Only the E half of the wall circuit and building survive in any form. The stones are 0.10-0.30m long, irregular in shape and set with a very rough inner and outer face which is not always flush or regular. It is bonded with a mud mortar and contains many smaller stones which are set between the larger stones and sometimes appear on the outer faces. There is no distinct rubble core and the wall is, on the whole, badly damaged. It sits in a type 1 foundation.

75. B98, Period 4, Type 4.

Poorly built wall of stone and mud ave. c0.43m wide and surviving 0.25m high as 1 course. It is set on the inner edge of a 0.70m wide mud bank which rests directly on surface 150. Large stones, c0.30 x 0.20m, are set along the outer face in places with much smaller stones, c0.10m, being used in the rest of the wall. There is a very high mud content. Large blocks set across the wall form the E and W doorjambs of an entrance way, **1702**, which lies in the S of the building. The interior wall face has been finished in a type 3 clay render. The wall appears to be set in a type 1 foundation.

Several broken artefacts have been incorporated into the wall structure.

87. **B86**, Period 4, Type 4.

Well built wall of mud and stones 0.25-0.54m wide and surviving 3 courses, c0.30m, high. There is a noticeable variation in building style in both plan and elevation. There are courses of large slab-like stones packed with smaller stones and overlain with courses consisting entirely of fist-sized cobbles set in a layer of mud. Most of the stones used are limestone. Some of the large flat slabs project almost entirely through the wall with only a small stone or mud course on the opposite face. There is generally a high proportion of mud in the wall consisting of a light orange/brown compact material with a high organic content. The impressions of tiny leaves and stalks are evident in parts of the SE arc. In places a regular inner and outer face of small stones with a core of mud and cobbles is seen although many of the smaller stones are commonly set at angles of 25-45^{o}. On the interior a basal course 0.20-0.35m high of carefully selected stones, some of which have been dressed, forms a well constructed skirting. They are laid with the corners of these subtriangular blocks always touching and set on a bed of pebbles and mud. The entire circuit of the wall is intact and is elliptical in shape and flattened to the S where the entrance, **94**, appears. The door jambs are formed from one large block to the W and small stones and mud on the E. The entire wall and building sit in a shallow type 1 foundation lying within the ruins of **B3**.

Several small finds were discovered in the wall structure including a fragment of a rubber and of a large limestone bowl as well as <u>KM573</u>, a red polished ceramic spindle whorl.

147. Over **B2**, Period 4, Type 4.

Short stretch of wall built in stone and mud 0.45m wide and surviving 0.20m high as 1 course. It consists of regular sized flattened stones, 0.10-0.15m long, and the occasional angular stone, all tightly fitted to form an even course. The facing stones on the NE outer(?) face are slightly larger where a row of untidily placed stones continue the arc of the wall. Traces of plaster (?), **427**, were also located. The wall is set over **1370** of **B206** and follows the curve of **168**.

148. Over **B2**, Period 4, Type ?

Short stretch of stone wall with an earth fill, 0.65m wide and surviving 1 course high. Built of limestone and calcarenite blocks, max c0.40m long, as an inner and outer face with an earth filled core. The stones are placed randomly flat or upright and are not closely fitted.

168. **B206**, Period 3b, Type 3.

Massively built stone and mud wall 0.85m wide at the base and surviving 4 courses high, 0.60m. The limestone blocks, max 0.50m long, are to form an inner and outer face with the flat edge facing outwards. The core is packed with many small stones and cobbles and there are many gaps between the stones indicating a fairly low mud content. Structural mud was found sitting on the top of the upper course of this stone base in the NE part of the arc where the 4 courses survive (sample <u>S253</u>). The interior wall is finished in a type 2 pink lime plaster on a mud render, **195**. The wall is set in a type 2 foundation, **1362**, with the wall itself sitting on a broad platform at the edge of the sccop. Exterior stone facing **1370** consists of loosely stacked irregular cobbles along the base of the wall inside the foundation cut but at a slightly higher level than that of the wall. Only a very short stretch of the entire circuit of this wall survives.

176. Abuts **B4**, Period 3b, Type 3.

Short arc of stone built wall with a mud mortar 0.60m wide and surviving 1 course high. It is built of large, irregular, undressed limestone blocks set as inner and outer facing stones with some blocks and cobbles making a rubble core. Some structural mud was present.

Small finds within the wall structure include two grinders <u>KM531</u> and <u>KM534</u> as well as an area of pottery broken *in situ* inside the wall.

186. **B200**, Period 4, Type 4.

Well built stone and mud wall 0.48m wide and surviving 2 courses high, 0.35m. Built in places of limestone and reef limestone blocks set as inner and outer facing stones with a flat edge facing outwards. The blocks are on ave. 0.18 x 0.16 x 0.10m in size. There is an occasional irregular block (max. 0.48m long) which spans the entire width of the wall. Stretches of the wall appear to be built entirely of a reddish mud with a high straw chaff content. The wall has been set in a type 2 foundation with the wall base being built hard up against the edge of the cut.

194. B204, Period 4, Type 4.

Well built stone wall with mud mortar, 0.40-0.60m wide and surviving 3 courses high, 0.23m. It is irregular in plan with large flat blocks used as facing stones in places but also with many smaller stones forming both the face and the core. The lowest basal course is built of large, fine flat faced stones set along the inner wall face. An entrance way to the W, **728/641**, is characterised by expanded wall terminals forming the door jambs, both of which are well preserved.

197. B206, Period 3b, Type 5.

Internal wall forming a type 3 floor division along the N edge of floor **744**. The wall is 0.30m wide and survives to a height of 0.55m. The wall does not bond in with the main wall of the building but is built up against it. It is built of fairly regular stone slabs forming a rough inner and outer face but with some slabs projecting through the wall. It is set in a matrix of mud (sample S267) and both faces are plastered with a type 1 havara clay render (sample S265).

261. B200, Period 4, Type ?.

Roughly built arc of stone wall 0.50m wide and surviving 2 courses high, 0.30m. It is built of irregular stone blocks and only the E face is preserved with no evidence of a core. Blocks extend for c1.30m to the W of this and it may be that this represents a type 4 stone foundation, not a wall.

Small find KM1141, a rubbing stone, comes from amongst the stones.

262. B493, Period 4, Type 4.

Short stretch of weel built stone wall with a mud mortar, 0.30m wide and surviving 5 coourses high, 0.54m. The basal course consists of irregular limestone blocks (0.22-0.33 x 0.14-0.33 x 0.08-0.15m) laid to fit in the most suitable position, some running through the entire width of the wall. These blocks are mianly situated along the inner face of the wall. The upper courses consist of smaller cobbles roughly forming an inner and outer face but also being used for the core. A high proportion of mud is used in the construction of the wall. The inner wall face has been finished in a type 3 plaster visible as two thin white layers. The wall and building have been set into what may be a type 2 foundation hard up against the edge.

Small find KM761 comes from within the wall.

281. Abuts **B4**, Period 3b Type 3/4.

Short arc of stone built wall base 0.50m wide and surviving 2 courses high, 0.20m. It is built of fairly large irregular blocks, max c0.40 x 0.30m set as inner and outer facing stones with little space left for any core material. Smaller stones and cobbles are also used as fillers where needed. There is no evidence for mud mortar suggesting that the wall may be partly dry stone.

282. Adjacent **B4**, Period 3b, Type ?.

Well built arc of stone wall 0.47m wide ans surviving 1 course high, 0.09m. It is built of large stones forming and inner and outer face with smaller stones and cobbles in the core.

289. B1000, Period 3b, Type 3.

Well built wall of stone and mud 0.60m wide and surviving max 2 courses high, 0.35m. It is constructed inlarge limestone and reef limestone blocks (0.15-0.25 x 0.30-0.40m) set as inner and outer facing stones with a few smaller cobbles as the inner core all set in mud. The wall is rectilinear in its overall plan with the W corner being well preserved and the N corner robbed. The inner wall face has been finished in a type 3 clay render. The building is set into a type 3 foundation cut with a layerof mud and pebbles supporting the inner wall face on the NE. An outer band of stones and cobbles is preserved in parts of the foundation cut along the exterior base of the W corner.

Small finds KM1942, an axe butt, and KM1943 come from the wall itself while conical stones KM1938-40 come from the foundation cut.

337. B1328, Period 3b, Type 3.

Stone built wall base 0.50m wide and surviving 1 course high, 0.20m. It is built of limestone blocks (0.30-0.40 x 0.20-0.30m) set as an inner and outer face with smaller cobbles being used as the rubble core. It is overlain by a 0.40m wide band of friable brown mud containing concentrations of pebbles.

344. B346, Period 4, Type 5.

Short stretch of stone wall with mud mortar, 0.36m wide surviving 2 courses high, 0.20m. It is built of irregular blocks 0.30m long spanning the entire width of the wall with smaller stones and mud used as packing and as the second course. Set in a type 2 (?) foundation scoop.

362. B376. Period 4, Type 5.

Poorly built mud and stone wall 0.58m wide at its maximum and c0.20m high. It is badly damaged and forms an eliptical shaped building with a a right angled corner at the N. The wall is constructed of large, irregular blocks frequently one stone thick, with smaller stone infill. There is little attempt to create inner and outer faces and the wall thickness varies considerably. It is consolidated in an mud mortar.

438. B736, Period 4, Type 4.

Short arc of stone and mud wall 00.50m wide and standing 2 courses high, 0.30m. It is built of stone and cobble with the stones being laid to form inner and outer faces along the flat edge of the stone. The core is of cobble and mud. Some stretches are buitl largely in mud or small stones only and occasionally large stones project through most of the width of the wall. The S terminal of the wall has been expanded and finished off as for a door jamb.

456. B494, Period 4, Type 4.

Well built stone and mud wall 0.55m wide and surviving max 2 courses high, 0.24m. It has been constructed with an inner basal course of large limestones (0.45 x 0.27 x 0.10m) some of which are dressed to give a flat inner edge. It has an outer face of smaller stones (0.24 x 0.16 x 0.05m) and a rubble core of cobbles. Water rounded stones and reef limestone are also used in the construction. The mud mortar is a compact crumble brown soil. Traces of a white plaster or clay render were detected on the inner face.

642. B732, Period 4, Type 3.

Short stretch of wall 0.64m wide and surviving 2 courses high, 0.38m. It is built of large limestone blocks (0.50 x 0.30m) set as inner and outer facing stones with a rubble core of cobbles. Some smaller stones are also used along the W face.

796. B1165, Period 4, Type 4.

Well built stone and mud wall 0.50m wide and surviving max 3 courses high, 0.30m. It is built of medium-large stones set as the inner and outer face to the wall with a mud and cobble core. There are stretches where the wall is built mainly in mud for one course and there are also stretches where small stones are used as facing stones. The mud content of the wall is quite high comprising c50% of the total bulk. The internal wall face has been rendered with clay, 1167, (sample S300) and one small patch is also preserved onthe exterior.

Broken artefacts have been incorporated into the wall including half a pivot stone in the W part of the wall.

798. B866, Period 4, Type 4.

Well built stone and mud wall 0.80m wide and surviving 4 courses high, 0.30m. It is built of large stones (c0.40 x 0.20m) laid as facing stones with a flat edge to the outside and fitted closely together. The core consists of medium-small stones and cobbles set in a fine, compact mud mortar. Traces of a wall finish in clay (?) were detected on the inner face.

Small find KM2367 comes from the wall structure.

831. B855, Period 3b, Type 3.

Well built wall of stone and mud 0.75m at its base and surviving 4 courses high, 0.56m. This is overlaid by a c0.10m thick layer of hard, reddish structural mud. The stone plinth is built of medium sized stones (c0.20 x 0.30m) laid as inner and outer facing stones which are also used along with cobbles as the rubble core. The core consists of c50% hard, compact, reddish mud. There are traces of a wall finish, **972**, on the inner wall face although its composition was not recorded. The wall is set in a type 4 foundation, **2066**, to the W and a type 2 to the E where the wall sits on a slight terrace at the edge of a large scoop.

858. B834, Period 4, Type 4.

Well built stone and mud wall 0.30-0.40m wide surviving 6-7 courses high, 0.70m. It is built of medium-large stones some set as inner and outer facing stones and some projecting through the entire width of the wall. Smaller stones and cobbles are also used on the wall face in places as well as in the rubble core. It is all set in a structural mud (sample S269) which comprises c50% of the bulk of the wall. The inner wall face has been finished in a havara clay render, **1270**, (sample S268) some of which has been burnished and painted (sample S284). The building and wall are set in a type 2 foundation scoop. A rickle of stones along the W side of the building, **1296/1371**, are set along the base of the wall. An entrance to the S, **1254**, is well preserved and is defined by the terminals of the wall at that point. No great care appears to have been taken with the construction of these door jambs although they are still survive in quite good condition. There is also a slight discontinuity in the width and orientation of the wall in the SE where a break may indicate some alteration.

Small finds incorporated in the wall include the fragments of a RW vessel smashed *in situ* on the top of the exposed wall, many worked stones and a mushroom shaped stopper.

869. B875, Period 4, Type 4/5.

Poorly preserved stretch of stone wall c0.40m wide. It is built of large blocks laid roughly as facing stones but generally projecting through the wall. Smaller stones and cobbles are also used as facers as well as packing in the core and around the larger stones.

910. No association, Period 4, Type 4(?).

Partially exposed and badly damaged arc of wall consisting of a face of large blocks and smaller stones with cobbles set in behind. It is irregular and badly built.

943. B994, Period 3b, Type 3.

Well built arc of stone and mud wall 0.50m wide at its base and surviving 2 course high, 0.16m. Overlying this stone footing is a compact, friable, reddish/brown structural mud (sample S182) similar to deposits lying inside the building. The base courses are of medium-sized limestone, reef limestone and calcarenite blocks laid as inner and outer facing stones with smaller stones and mud in the core. There are stretches where smaller stones are also used as facers and there are two stretches where no stones appear, only a layer of structural mud. The inner face has been finished in a whitish/yellow havar clay render (sample S182). The wall is set in a type 2 foundation, **1119**, with the wall built neatly against the edge.

975. B1052, Period 4, Type 4.

Stone and mud wall of varying thickness and quality. In the NW at the massively built E door jamb it is 0.65m wide and narows to 0.45m for most of the E section. The W wall is 0.23-0.30m wide where it appears to be supported on the interior by 4 postholes, **2166**, but broadens out towards the W door jamb. It survives 5 courses high, 0.44m. The N and E wall is built of medium-sized blocks forming a rough inner and outer face with smaller stones and cobbles being used in the core and occasionally along the faces. The E door jamb for entrance 1135 is expanded and built with much larger stones. In the W the wall is only 2 stones thick and is more like a rubble constructed wall. Mud mortar is used throughout. The wall is set into a type 2 foundation on the N and E but in the S it is fouonded more shallowly on smaller stones.

1004. B1016, Period 3b, Type 3.

Well built wall base of stone with the mud mortar preserved only in the E where the wall is 0.60m wide surviving 2 courses high. It is built of limestone and calcarenite blocks (ave. C0.26 x 0.20 x 0.10m) laid as inner and outer facing stones on a bed of mud. Smaller stones and cobbles are used as the rubble core. This is surmounted by stone courses which appear to have a lower mud content and may be partially dry stone or badly eroded. Along the base of the interior a series of slabs set on edge, **1024**, forms a type 4 wall finish and there is also some evidence of an applied plaster or render although the type of material is not recorded. The wall is set into a type 2 foundation 0.05-0.07m deep on all sides.

Small finds from within the wall include: KM2967-8, KM3428 and KM3667.

1047. B1046, Period 4, Type 4.

Well built stone and mud wall 0.40-0.60m wide and surviving 3 courses high, 0.30m. It is built of small, irregular shaped stones laid roughly as inner and outer facing stones although the same stone size is also set randomly within the mud core. Occasionally larger blocks are used although the wall, on the whole, has a very high mud content. The wall is narrower along the SW arc where it has been thickened by the addition of a further layer of stones against the face of the wall. The entire circuit of this wall is preserved including the entrance way, **2017**, framed by two door jambs which have not been accorded any special treatment. The inner wall face has been provided with a type 4 revetting and clay render, **2025**, which also extends along the E door jamb to the exterior corner of the door. The S exterior wall face preserves a wall render, **1047**, although there are no details about the material from which it is made.

One small find, KM2145, was recovered from the wall.

1091. B1161 contemporary, Period 3, Type 5.

Fragmentary stretch of stone wall base 0.36m wide. It is built of large blocks (0.20 x 0.18 x 0.10m) with one block (0.38 x 0.38 x 0.40m) laid in a row with smaller stones to fill out the shape of the wall. No evidence of any mud mortar survives.

1092. B1103, Period 3b, Type 3.

Well built stone wall base with mud mortar, 0.40m wide and surviving 4 courses, 0.54m high. It is built of limestone and calcarenite blocks (0.25 x 0.20 x 0.10m) laid as inner and outer facing stones but not as neatly as in some of the larger buildings from the period. The core is of mud with some smaller stones. The wall survives 2 courses high on the outside but 4 on the inside indicating that it is sitting on the sloping terrace of a type 2 foundation. The slight rickle of stones along the SE arc may represent the stone packing of the cut. There is no finish on the preserved on the interior wall face but the S exterior wall face has been plastered.

1109. B1161, Period 3b, Type 3/4.

Roughly built stone wallwith mud mortar, 0.50m wide surviving 3 courses, 0.55m, high. It is built of limestone and calcarenite blocks 0.30 x 0.20 x 0.15m laid as inner and outer facing stones with smaller cobbles and stones forming a rubble and mud core. About 35% of the stones have been roughly dressed. The wall terminals thicken at the doorway **2002** and at the blocked entrance (?) **1691** where one of the terminals is built largely of mud. The building itself is rectilinear and the NE and SE corners being slightly rounded and the NW corner right angled. There is evidence in 3 places of a sudden change in the wall width suggestive of rebuilding, especially in the W where the S part of the wall is more roughly built. It is possible that the rubble 1108 represents wall collapse which would double the present height of the wall. However, the evidence for *in situ* structural mud which should still survive is not convincing.

1208. B1295, Period 3b, Type ?.

Well built stone and mud wall 0.48m wide and surviving 5 courses, 0.46m, high. The building is rectilinear with the surviving S and E corners being slightly rounded. It is built of limestone and calcarenite blocks, 0.17-0.40 x 0.17-0.25 x 0.07-0.10m, laid as inner and outer facing stones with cobbles and smaller stones set as the core. The larger, dressed stones tend to be on the outer face although dressed stones do appear on both faces and snecking stones are used. Mud mortar between the stones and in the core is recorded in places but does not appear to have been used excessively. The wall is set on a type 3 foundation which is seen most clearly in the SE where ther is a deep foundation cut with the wall base set over the lip of the cut and and the inner face supported on a pebble and mud ledge. The inner wall face has been finished in a fine plaster/render, **2004**, but the exact material was not recorded or iinvestigated.

1299. Post **B1295**, Period 3b, Type 3.

A short stretch of stone wall base 0.51m wide surviving 1 course, 0.16m, high. It is built of large calcarenite and limestone blocks set as inner and outer facing stones. No rubble core survives. A line of "plaster" connects this wall with 2039 suggesting that they may both be part of the same wall.

1367. No association, Period 3, Type 3.

Short stretch of stone wall base 0.40m wide surviving 1 course, 0.29m, high. It is built of large limestone blocks, 0.17-0.23 x 0.13-0.18 x 0.18-0.13m, set as inner and oouter faciing stones with no surviving rubble core. No mud mortar was detected in the structure and some of the stones were roughly dressed.

1396. Cuts **B1046**, Period 4, Type 4.

An S-shaped stretch of wall 0.40m wide surviving 0.20m high. It id built of small-medium sized stones set as inner ans outer facing stones with smaller fist-sized stones as the rubble core. No record was kept of any mud mortar within the structure although it must have existed to hold such a wall together.

1398. Pre **B1295,** Period 3a, Type 3.

Partially exposed arc of wall base min 0.50m wide. It id built mainly of large calcarenite blocks set as outer facing stones with small irregular cobbles as the rubble core. The inner face is not exposed.

1401. Pre **B206,** Period 3b, Type 3.

Stretch of well built stone wall base 0.62m wide surviving 2 courses, 0.21m, high. It is built of large blocks set as inner and oouter facing stones with a mud mortar and many small cobbles as the rubble core.

1540. B1547, Period 3a, Type 3.

Well built stone wall base with a mud mortar 0.45m wide surviving 3 coourses, 0.25m, high. It is built of large, 0.35 x 0.20 x 0.15m, stones set as an inner and outer face with smaller fist sized stones forming a rubble core. The interior wall face has been "plastered" although the type of material was not recorded, **1551**.

1564. B1565, Period 3a, Type 3.

Stone wall base with a mud mortar, 0.40m wide surviving 1 course, 0.10m, high. It is built of rough stone blocks and an inner face of flatter stones with smaller cobbles in the rubble and mud core. The stones are not tightly fitted together. The outer face rests on the lip of a type 2 foundation cut with the inner face set just within that lip. The cobble and silty make up, **1566**, of floor **1558** runs up against the iner face of the wall suggesting a type 2 wall finish of plaster on a mud render.

1691. B1161, Period 3b, Type 5.

Roughly built stretch of rubble wall in the SW corner of B1161, c0.30-0.40m wide. It is built 1 stone deep of large irregular limestone and calcarenite blocks and may be the blocking of an entrance.

2039. Post **B1295.** Period 3b, Type 3.

Short arc of wall cutting B1295, possibly part of 1299. It is 0.50m wide and survives 0.40m high for several courses. It is built of large rounded bouldes with flat surfaces set as inner and outer facing stones in a mud mortar. Some of the stones are dressed and the size of them leaves little room for a rubble core.

A1.2 Entrances.

B1. Period 4, Type 3?.

Position of the entrance is unclear, but there is a gap in the wall in the NE and in the SW where it has been cut by pit **19**. An entrance in SW would place it in alignment with pit **11** inside the building, containing two fragmentary edge-set quernstones, and the central hearth. This would indicate a type 3 entrance. Postholes **16, 22-3** in the SW corner, however, may frame another type of doorway arrangement with the suggestion of a possible porch. The floor in this area is higher than the exterior surface, sloping down to meet it.

B2. 1695, Period 3b, Type 2?.

A gap in the wall in the S is the only evidence for an entranceway as both door jambs appear to have been removed. A plaster floor, **389**, lies on the right upon entering the building with the remains of a hearth, **41-2**, placed centrally. A radial floor division bordering the plaster floor cuts across a direct line from the door to the hearth.

B3. 607, Period 4, Type 3.

A fairly well preserved entrance in the S of the building is represented by a stone paved threshold, **606/7**, and a socketed stone, **1705**, sitting to the W. The W doorjamb has been destroyed but the E is still partially preserved and has been built of roughly squared limestone blocks. The max width of the doorway is 1.20m. A doorstop and a further group of socketed stones, **2140**, sits against the inner E doorjamb. Immediately in from the doorway an edge set stone, 1711, is set into a shallow pit, **876**. A group of stakeholes, **2173**, between the doorway and **1711** may also be associated with the general arrangements around the door.

B86. 94, Period 4, Type 3?.

A very well preserved entrance in the SE of the building is paved with a single large threshold slab. The wall at the entrance flattens out and the doorjambs are slightly inturned. The W jamb is built in one of its courses of a single large slab while the E jamb is more roughly built and is about half the thickness of the rest of the wall. A pit, **93**, against the interior W jamb may possibly have held a socketed stone, now gone. An upended broken quernstone, <u>KM596</u>, lies on the floor immediately in from the doorway and it is tempting to think of this as an edge set stone which has become dislodged.

A second possible entrance in the N of the building, **202**, is represented by a gap in the wall and may be a type 4 entrance.

B98. 1702, Period 4, Type 3.

A good entrance in the SE of the building with both doorjambs preserved and built of large, irregular but flat-faced limestone blocks. A socketed stone, **1703**, sits against the inner W doorjamb and between the entrance and the hearh, **124**, is an edge set stone, **1707**. The floor of the building, **128**, slopes down to the exterior surface, **17**. The doorway is very narrow being only 0.30m wide max.

B200. Period 4, Type 1.

A broad well preserved entrance in the SE of the building with both the doorjambs preserved. The stone-built threshold is covered with a clay floor, **644**, which spreads out in a pathway beyond the doorway in contrast to the interior which is paved with stone slabs, **390**. A raising of the interior floor level is accommodated a the threshold by a rough stone cobbling, **645**. A "plaster" basin, **643**, in which sat a vessel, is situated just to the E of the doorway against the exterior wall. No socketed stone was found on an otherwise well preserved interior floor surface. The width of the door is 0.85m.

B204. 728, Period 4, Type 1.

A well preserved entrance facing W with both doorjambs intact. The walls of the building increase in width by c0.20m to form expanded terminals at the doorjambs and are constructed using a concentraion of larger stones. The floor of the building, **377**, slopes downwards and out over the earth threshold, **641**, to an exterior surface, **387**, riddled with stakeholes extending over the entire area in front of the building. A socketed stone, <u>KM645</u>, sits by he N doorjamb lying slightly over the threshold although, it may have been dislodged into this position. A "plaster" basin, **634**, sits against the wall of the building just to the S of the entrance. The doorway is 0.72m wide.

B736. Period 4, Type 1?.

One doorjamb is preserved, the E side, indicating an entranceway facing S. No threshold or floor surface survives. The wall terminal has been widened by 0.15m at the doorjamb.

B834. 1254, Period 4, Type 3.

A well preserved entrance facing S with both doorjambs surviving intact. The threshold is of earth or clay which has been relaid on at least one occasion. A sharp division along the outer surface of the threshold with the exterior surfaces suggests special attention being focussed on he construcion of the threshold. A socketed stone, **1698**, lies against the interior of the W doorjamb and an edge set quernstone, **1699**, lies 1.20m directly in from the entrance. The interior wall plaster, **1270**, has been carried out along the faces of the doorjambs. The doorway is 0.80m wide.

On the exterior, seven postholes; **1403-5**, **1407** and **1424**, form a splayed pattern on either side of the entrance and may indicate the presence of some sort of open porch. Gullying adjacent to the postholes may also be a drip trench formed from water falling from the roof of the porch.

At some point during the lifetime of the building the entrance was completely sealed with a stone and mud blocking which survives to the current height of the wall of the building. There is no indicaion of a secondary entrance although the N part of the wall circuit has been destroyed by pit **863**.

B1000. Period 3b, Type ?

An area paved with flat slabs incorporating a socketed stone, <u>KM5038</u>, on the SW of the building may indicate a possible entrance although the wall does not survive well enough in this area to make identification more reliable.

B1044. 1060, Period 4, Type 3.

Partially preserved entrance facing NW with the E doorjamb surviving intact. The wall terminal at this point is finished in slightly larger stones along the face of the jamb. The threshold is a havara/clay white plaster which is continuous with the floor **1171**. A socketed sone, **1638**, sits just inside the E doorjamb and 1.0m in from the doorway is an edge set stone, **1684**, and posthole immediately before the hearth.

B1046. 2017, Period 4, Type 3.

A well preserved entrance facing NW with both doorjambs intact. The threshold forms a continuous surface with the floor, **2000**, which slopes down sharply to the centre of the building. The doorjambs are constructed in the same manner as the rest of the wall **1047** with cobble sized stones and mud in roughly equal proportions. Wall plaster adhering to the NW corner of the doorjamb indicates that both the jamb ingoes and the exterior wall surfaces were plastered with a havara clay render. A socketed stone, **1685**, sits in the interior floor just inside the E jamb and c1.20m in from the doorway sits an edge set stone, **1686**, just before the hearth **1495**. The top of this stone has been dressed to form a flat surface. Lying in a band just in from the entrance and before **1686** a group of stakeholes, **2030**, runs N/S. The doorway is 0.85m wide.

B1052. 1135, Period 4, Type 3.

A partially preserved entrance facing NW in which only the E doorjamb is intact. The wall at this point expands expands by c0.15m to form a thickened terminal in which much larger limestone blocks are used. The threshold dips into the building and forms a continuous surface with the floor. Several floor surfaces were recorded in the building which is reflected in the two socketed sones, <u>KM5027</u>, lying just inside the E jamb. An edge set stone, **1689**, sits 0.60m in from the doorway. The entrance is 1.0m wide max.

B1161. 1691 & 2002, Period 3a, Type 1 & 4.

Two entrances are preserved in this building. Facing E is a well constructed entrance, **2002**, wih both doorjambs intact, the N one consisting of a wall terminal expanded by c0.20m. The threshold is paved in flat slabs built with an inner and outer face and a rubble core in much the same manner as the wall construcion. It may well be that this represents a secondary entrance and that the threshold is in effect the basal courses of the wall at that point. The exterior surface is also paved in large flat slabs, **2091**, and later repaved in large cobbles, **35**, above the level of the original threshold. The width of this entrance is 0.80m.

Another entrance in the SW corner of the building has doorjambs consisting of two expanded wall terminals, the S one being constructed largely in mud unlike the rest of the wall. The threshold appears to be continuous with the floor **1300** and a socketed stone, **1690**, sits just inside the N jamb. A rubble wall,**1691**, seals the doorway but is only half the thickness of the jambs creating a corner niche in the building. The entrance is 0.90m wide.

B1165. 1170, Period 4, Type 3.

A poorly preserved entrance is represented by a gap in the S part of the wall of the building. A socketed stone, **1692**, sits just inside the probable location of the W doorjamb and an edge set quernstone, **1693**, sits 1.50m in from the entrance in he plaster apron, **1420**, around the hearth **1359**. A posthole, **1442**, and 10 stakeholes lying directly in the entranceway are, presumably, not contemporary with its use as a doorway although they may represent some form of door locking mechanism.

B1295. Period 3a, Type ?.

An edge set stone, **1694**, is the only clue to the potential exisence of an entrance along the SE wall of the building in an area where it has been totally destroyed.

B1547. 1605, Period 3a, Type 2?.

A partially preserved entrance facing S is repsresented by the E doorjamb only. The entrance is located immediately to the W of an area of floor, **1546**, bounded by two radial floor divisions, type 2 ridges, one of which terminates at the E doorjamb. At this point, a stone set against the interior of the jamb has been inerpreted as a possible door check. A cupped stone, KM5006, and a flat stone, **1704**, set on edge 0.90-1.0m in from the doorway along the side of the ridge, **1572**, have also been linked with doorway arrangements.

At some point, a rubble and mud plug, **1603**, was laid over the original earth threshold extending out beyond the doorway. Apart from a smoothed inner face, the poor preservation of this feature makes it to interpret. It may have functioned as a raised threshold or as a door blocking.

A1.3 Floors.

Although many exterior surfaces have been recorded at *Kissonerga* they will, apart from a few exceptions, be disregarded for the present purposes. Only floors inside buildings where intent of construction can be demonstrated, if only by the act of enclosure, will be considered. In most cases, the material from which the floor is made is indicated by the type of floor and is only described more fully a difference or particular feature is noted.

15. B1, Period 4, Type 1.

The rubble layer, 28, which overlies B4 forms the base for this floor. It has been stained red in patches in the W half of the building. 11.45m^2 survives.

69. B96, Period 4, Type 2/3.

A hard grey "plaster"-like material overlain by patches of whiter "plaster" which curves up the base of the wall. Very badly damaged.

90. B86, Period 4, Type 3.

A finely laid smooth, white clay/havara plaster over the earth floor base in the N and E of the building. It is 0.02-0.03m thick and survives for $12.88m^2$.

120. B98, Period 4, Type 2?

The very badly preserved upper floor of the building composed of a soft poorly compacted earth base.

128. B98, Period 4, Type 2.

Earliest earth floor in the building of compact grey ashy material which curves up at the wall base where some patches of clay plaster survive.

131. B2, Period 3b, Type 3.

A thin lime plaster skim lying against the N wall of the building is preserved as an irregular area and curves up the wall to the wall plaster. c1.50cm thick. $8.44m^2$ survives. Sample: S249.

185. B200, Period 4, Type 5.

A layer of pebbles and grit se in a bed of soft red/brown fine gritty silts and overlain by patches of clay/havara? plaster. It overlies 390 and is 0.06m thick surviving for $c8.72m^2$.

222. B86, Period 4, Type 2/3.

This is the earliest floor in the building and is of a fine, hard, smooth flakey clay/havara plaster 0.01-0.04m thick. $c10.0m^2$ survives.

291. B4, Period 3b, Type 4.

A solid lime plaster floor in the SE part of the building bounded on the N and W by radial floor divisions **304/991**. A small patch of lime plaster floor also exists to the N of this. The floor is pierced by two pits, **307**, and a distinct pattern of stakeholes, **314**, which must have been in place while the floor was being laid. It is ave.0.20m thick and survives for $16.05m^2$ giving an estimated volume of $3.20m^3$. Sample: S271.

361. B376, Period 4, Type 2.

Thin hard, brittle havara plaster floor 0.03m thick. Latest surface in building.

377. B204, Period 4, Type 3.

A thick layer of hard grey/brown "plaster" with gritty inclusions and a knobbly surface which has been laid over an ashy layer. The floor is dome shaped rising slightly towards the centre of the building. It is 0.06m thick, survives for $c5.62m^2$ and has an estimated volume of $0.34m^3$. the description of the surface and material suggests that it may be a lime plaster.

389. B2, Period 3b, Type 4.

A solid lime plaster floor in the SE of the building bounded along its N and W edges by the very poorly preserved remains of two radial floor divisions, **1074**. The edges are badly damaged and do not abut directly against the wall face in the SE. Several pits and postholes are cut into the floor; **290**, **734** and **2164**. It is 0.20-0.25m thick with $17.09m^2$ surviving giving an estimated volume of 3.40-$4.30m^3$. Samples: S272-3.

390. B200, Period 4, Type 5.

Single layer of limestone blocks cut and fited to pave floor of building. Ave size is 0.50x0.30x0.25m. They are closely fitted with smaller stones inserted into the gaps and infilled with silty deposits. Small finds: KM802-6.

433. B736, Period 4, Type 1.

Earth floor founded on underlying deposits.

497. B4, Period 3b, Type 1.

A small patch of earth floor to the W of plaster floor 291 and underlying it. Very little of this survives but it does appear to be the original bare earth floor of the building onto which the constructed floors and hearth have been set.

651. **B493,** Period 4, Type 1.

Poorly preserved earth floor which may have had a thin "plaster" skim over it.

695. **B3,** Period 4, Type 2.

The badly defined floor of this building is made up of a silty clay matrix with indications of structural mud and weakly developed microscopic clay structures. Along the edge of the floor the clay wall plaster curves down to merge with the floor deposits. The compacted area of the floor is 0.02m thick and survives for c50.0m^2 giving a total volume of 1.0m^3. Samples: S279/305. Small finds: KM1841-2, 2228.

744/976. **B206,** Period 3b, Type 4.

Thick, solid floor of lime plaster laid on a rubble base in the SE part of the building, bounded along the N edge by radial floor division **197**. It is 0.14-0.25m thick and covers 39.0m^2 giving an estimated volume of 5.50-9.75m^3. The material is a dense lime plaster with large angular red gravels and pebbles. Sample: S172, S266. See appendix 4 for analysis of floor material.

753. **B493,** Period 4, Type 2/3.

A badly preserved floor represented by occasional patches of white "plaster". 0.02-0.05m thick.

762. **B494,** Period 4, Type 2/3.

A very badly preserved floor represented by patches of white "plaster".

952. **B855,** Period 3b, Type 2.

Covers most of N part of building and is composed of "packed" clay. Ridge **963** divides the floor which is flat and smooth to the SE but rougher and more irregular to the W.

968. **B206,** Period 3b, Type 3.

Very small patch of floor preserved to the N of radial wall **197** made up of layers of lime plaster stained pink and worked smooth. 0.19m thick. Sample: S295.

983. **B994,** Period 3b, Type 2.

Hard, light brown compact havara plaster surface 0.05m thick which runs up wall base to meet wall plaster. Stones and cobbles of underlying layer protrude through.

1027. **B1000,** Period 3b, Type 2/3.

Thin layer, 0.05m, of hard white "plaster" laid directly onto earth surface. Continues up wall base to form wall "plaster" and has been built out at the corners of the building to give a more rounded shape to the interior. It has been modelled to form basins **1214** in the E corner of the building.

1118. **B866,** Period 4, Type 2.

Poorly preserved white clay/havara(?) plaster floor 0.15m thick. Small finds: KM1769, 2456-60.

1125. **B834,** Period 4, Type 1.

Surface founded on compact grey/brown fine silty deposit with pockets of grainy sediments, clasts and many air pockets. 0.26m thick. Sample: S201.

1152. **B1547,** Period 3a, Type 2/3.

A series of 4 floors lying to the N of ridge **1548**. Uppermost is a mud floor overlying a "mud plaster" floor containing areas of red pigment. Beneath this was a white "plaster" floor which overlay a nodular "plaster" floor **1578**. All floors are 0.03-0.055m thick.

1166. B1165, Period 4, Type 3?

Hard "plaster" which runs up to the edges of the lowest course of stones in wall **769**.

1171. B1044, Period 4, Type 2?

Very patchy thin white "plaster" 0.02m thick with indications of internal laminations. Havara plaster?

1173. B1044, Period 4, Type 1.

Earth floor compacted 0.02m thick onto brown silty soil.

1174. B1052, Period 4, Type 3?

Patchy, friable white "plaster" surface 0.01m thick.

1192. B1103, Period 3b, Type 4.

Lime plaster floor 0.032-0.052m thick in SE part of the building. Pierced by pit, **1286**, and many postholes, **2145-51**. Sample: S280.

1194. B1052, Period 4, Type 3.

Hard white plastery mud tinged and flecked with red/brown particles and located in W part of the building. Patched in places in a more friable white "plaster" 0.04m thick. Badly preserved in E of building.

1228. B834, Period 4, Type 3.

White "plaster" layer 0.07m thick laid over earth surface. Repatched in mud and "plaster". Small finds: KM2165, 2495-6, 2417-8, 2479, 2510, 2561.

1300. B1161, Period 3b, Type 3?

Patchy white "plaster" floor laid against walls and oven **1275**.

1301. B1295, Period 3a, Type 3.

A "plaster" wash over a foundation layer of rough pebbles set in a mud matrix.

1508. B1016, Period 3a, Type 3.

Lime plaster layer 0.004-0.010m thick laid directly onto earth surface. Runs up to ridges **1522**, **1524**, hearth **1520** and orthostats at base of wall. Sample: S313. Small finds: KM2104.

1519/1523. B1016, Period 3a, Type 5.

An area of large stones/cobbles, **1523**, along the E wall of the building and a distinct area of pebbles, **1519**, to the W, both bounded by ridges **1522** and **1524** form an irregular surface. All are closely packed 2 stones/pebbles deep on a thin bed of mud although the stones themselves are not consolidated in a mud matrix. This overlies floor **1508** and may represent the base of an incomplete type 4 lime plaster floor.

1546. B1547, Period 3a, Type 2.

A level and very smooth mud floor made of a hard brown soil matrix with many grass impressions and silicates. Curves up behind white wall "plaster". It lies in the SE part of the building and has been laid as one with ridges **1548** and **1572** which define its area.

1558. B1565, Period 3a, Type 2.

A series of up to 4 successive floors 0.03-0.12m thick of mud plaster which has been compacted and smoothed. They slope up to the wall base in a gradual ramp. Most surfaces are discontinuous and appear more as re-patchings.

1578. B1547, Period 3a, Type 2.

A compact grey/brown silty mud floor with occasional patches of red pigment.

1592. B1590, Period 3a, Type 2.

Two successive compacted mud floors 0.04m thick overlying 0.09m of softer ashy material. Patches of powdery red pigment appear on the lower floor.

2000. B1046, Period 4, Type 2.

Hard, laminated (havara?) plaster which runs up the wall base to form the wall "plaster".

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A1.4 Hearths.

10. B1, Period 4, Type 3.

Irregular, badly damaged hearth 0.50x1.0x0.05m set into a shallow pit 0.50x0.22m lined with a "plaster". Firebowl is roughy circular and is made of a harder "plaster" which is reddened in section. There is a layer of grey/brown soil in the pit onto which the hearth plaster has been applied.

41/42. B2, Period 3b, Type ?

A shallow pit 1.30x1.24m filled with large irregular, heat cracked stones (c0.20m long) around its edge and pebbles in the centre. Patches of hard, burnt reddish clay with straw impressions overlie the stones and pebbles.

78. above **B2,** Period 4, Type 3.

A badly preserved circular platform, 0.70m dia x c0.05m deep, constructed of a silty clay plaster laid over a bed of stones and with a rough firebowl at the centre. Set into surface **84**.

91. B86, Period 4, Type 3.

Circular depression, 0.48m dia x 0.20m deep, set into floor **92** and luted with "plaster" into which small pebbles/stones have been set.

124. B98, Period 4, Type 3?

A badly preserved roughly circular hearth, 0.90x0.74m, construtced of laminated layers of silty clays and layers of small irregular pebbles set into the mouth of the shaft to **Gr505**.

137. above **B206,** Period 4, Type 3.

A circular platform hearth, 0.90x0.80x0.15m, sitting on a loose ashy deposit, **779**, with "plaster" floor **164** abutting it. The firebowl is 0.20x0.15m. It is constructed in a pinkish/brown compact friable mud covered in a thin layer of "plaster".

172. B96, Period 4, Type 2/3?

A badly damaged, roughly circular hearth, c0.60x0.03m, which has been finished in a white "plaster" and which has a gap for a firebowl preserved. It sits on floor **69** but there is no evidence of it being set into a shallow pit.

370. B376, Period 4, Type 3.

Circular platform hearth, 0.53x0.64x0.13m, which sits on an earlier hearth, **618**. It is constructed in a light brown mud with voids c0.01m in size into which a grey/brown silty ash has been deposited. There are pebbles saprsely distributed throughout the matrix with clasts of a dense plaster-like material, 0.01-0.14m dia. The firebowl is 0.05m dia and is lined with an orange/brown mud

0.005m thick with dense chaff impressions and finished with a smooth 0.001m thick layer of a fine grey mud plaster.

434. B736, Period 4, Type 3.

A circular flat topped, straight sided platform hearth, 0.56x0.50x0.16m, which sits on floor **433** and is built entirely of mud with no plaster being used. The firebowl is centrally positioned and is 0.25 dia x 0.12m.

495. B493, Period 4, Type 2?

A shallow circular scoop, 0.92x0.85x0.12, with mud and stones forming the sides and base is situated just inside wall **262** and is part of the secondary use of the building.

618. B376, Period 4, Type 2/3?

His survives as a broad shallow scoop, 0.75x0.73x0.15m, lined with "plaster" 0.05m thick. It sits over the firebowl of hearth **770** and is sealed by hearth **370**.

770. below **B376,** Period 4, Type 3.

Circular platform hearth, 0.60x0.60x0.14m, with a well defined firebowl, 0.25x0.14m, which has an indistinct base. It is set into a shallow pit 0.80x0.20m, and the "plaster" surface has been destroyed.

784. B206, Period 3b, Type 4?

Sitting at the apex of the plaster floor **744** at the centre of the building this hearth survives as a roughly rectangular cobble base, 2.0x2.20x0.05m, set into a slight depression and partially overlying the plaster floor. The surface is badly damaged and consists of a layer of soft friable brown/white mud and cobbles (0.10x0.07m) which is overlain by a hard white plaster 0.07m thick containing small (<0.04m) pebbles.

828. B3, Period 4, Type 3.

A circular platform hearth, 1.30x1.30x0.05m, with a dished surface, sloping sides and a slight apron sits on the floor of the building. The central firebowl is 0.27x0.10m. the surface is a smoothed whitish "plaster" with traces of red pigment and signs of refurbishment.

843. above **B206,** Period 4, Type 2.

A shallow "plaser" lined basin, 0.55x0.45x0.14m, filled wih ash and charcoal sits on surface **842**. A line of 4 stones lies along the edge of the hearth.

951. B855, Period 3b, Type 4.

This rectilinear platform hearth, 1.80x1.40x0.11m, sits on floor **952** and is well preserved in the N and W sides into which a plaster basin complex is built. The hearth is constructed with an outline of edging stones infilled with smaller irregular stones sitting over a small pit, 0.13 dia x 0.05m, containing figurine KM2086. Over the stones was laid a layer of sherds set in a clay plaster with the outer face upwards. They are carefully set to provided an even surface and there are indications of many *in situ* breaks. It was finished with a clay plaster 0.04m thick which had been finely smoothed and contained dense chaff impressions. The firebowl is 0.30m dia and has been burnt a maroon colour unlike the rest of the hearth which is an orange/red colour.

990. B4, Period 3b, Type 4?

A large roughly squared area of stones, 1.80x1.10x?m, sits at the apex of the plaster floor where it is joined by two mud and stone filled channels running along the edge of the floor. There is a slight reddish discolouration of the surface of the hearth area.

1041. B1044, Period 4, Type 3.

A circular platform hearth, 0.64x0.54x0.09m, set onto floor **1071** overlying hearth **1209**. It is constructed of a compact, friable, granular white "plaster" with a well smoothed surface and a central firebowl, 0.20x0.16m. There are two small holes, 0.08x0.05m, on the surface of the hearth but neither shows signs of burning.

1164. B206, Period 3b, Type 4?

A cobble foundation with edging stones, 0.67x2.20x0.11m, set in a hard reddish mud and located directly beneath hearth **784** may in fact be the foundation for that hearth.

1209. B1044, Period 4, Type 3?

A roughly circular platform hearth, 0.60x0.56x0.13m, sits on the earliest floor of the building and is badly damaged by the later hearth wih the firebowl being destroyed. It is constructed with a "plaster" finish over an orange "plaster"/soft ashy soil base.

1250. B834, Period 4, Type 3.

A circular platform hearth, 0.92x0.96x0.09m, sits on the upper floor **1228** of the building and is largely intact apart from its N edge which has been destroyed by a later pit. It is finished in a havara clay plaster with over 10 colour gradations apparent on the outer edge.

1294. B1295, Period 3b, Type 3.

A circular platform hearth, 0.45x0.70x0.12m, with a central firebowl sits on floor **1301** and is finished in a "plaster" surface which is badly cracked and broken.

1307. E of **B834,** Period 4, Type ?

An area of cobbles, 1.16x0.50x0.10m, covered with soft, fine, black ash with traces of a "plaster" surface and apron are all that define this badly damaged feature.

1357. B1165, Period 4, Type 3.

A large circular platform hearth, 1.08 dia x 0.06m, sits on a broad irregular plaster apron, **1420**, which is stained purple in places. Four postholes, **1443-6**, penetrate the apron on the W side and one, **1455**, pierces the W side of the hearth. The apron also engulfs an edge set quern stone **1693** to the S. The plaster surface of the hearth is badly damaged and the laminated applications of plaster indicate frequent repairs.

1390. B1044, Period 4, Type 2/3?

Located beneath hearth 1209 this badly damaged roughly circular, 0.43x0.36x0.07m, shallow basin-like hearth is lined with a coarse pale orange clay havara plaster with a low ridge along along the S edge and traces of one along the N edge.

1495. B1046, Period 4, Type 3.

This circular platform hearth, 0.80 dia x 0.06m, has a finely made firebowl and is finished in a fine "plaster". It sits on floor **2000**.

1520. B1016, Period 3a, Type 4.

A rectangular platform, 1.50x1.15x0.15m, of small pebbles set in a crumbly reddish clay and finished in a 0.01m thick layer of havara(?) plaster lies at the centre of the building. It is badly preserved and has a slight depression at the centre which may be the firebowl and to which the hearth surface slopes. The remains of a possible oven were located built over the top of this.

1563. B1565, Period 3a, Type 3?

A circular platform, 0.80 dia x 0.06m, of cobbles and pebbles covered with a smooth slightly granular "plaster" sits on floor **1558** and survives several refurbishments of the floor. There is a red discoloration at the centre of the hearth and traces of "plaster" beneath the cobbles may represent an earlier hearth. Small finds: KM3567-8, 3602.

1591. B1590, Period 3a, Type 3.

A badly damaged circular hearth, 0.75 dia x 0.09m, is constructed in a mass of whitish marly plaster with a few small cobbles and pebbles at the core. This is smoothed off to a very fine finsh but there are traces of a whitish "plaster" 0.02m thick in places. A blackened fragment of the firebowl survives and two floor surfaces are built up against the hearth.

1070. B1052, Period 4, Type 5.
An oven set into a NW/SE pit, 0.90x0.85x0.36m, is adutted by floors **1174** and **1194**. It is composed of a layer of soil 0.06-0.12m deep on the base of the pit covered wih ash 0.03m deep and overlain by a poorly fired heavily gritted coarse ceramic lining. An open ended horse-shoe shaped bank of stones and cobbles two courses high set in mud and constructed on top of the ceramic lining is open towards the doorway of the building. There was no evidence for any superstructure.

1170. B866, Period 3b, Type 5.
An oven set into the slump of the entrance to the underlying building **B1165** is defined as an E/W oval setting of edge-set stones 0.90x0.60x0.29m in a shallow pit. It is lined with clay to bond the stones and here is a further inner lining of a coarse ceramic fired *in situ* to give a smooth outer face and an irregular inner face. This covers the sides and base of the oven and is largely broken up.

1275. B1161, Period 3b, Type 5.
An oven set on floor **1300** is constructed on a SW/NE axis, 1.05x0.87x0.25m, of round limestone blocks and mud to form a low bank. It is lined with "plaster" and there is also a coarse ceramic lining which does not survive *in situ*. The whole structure is badly damaged.

1486. pre-**B1295,** Period 3a, Type 5.
An oven defined by an arc of limestones and sandstones set in a light coloured mud, 1.00x0.75x0.27m. It is lined with a coarse red/orange ceramic on the upper part and a hard yellow/orange fabric on the base.

A1.5 Radial Floor Divisions.

000. B994, Period 3b, Type 2.
A broad, shallow irregular channel, 1.60x0.90x0.05m, runs NE/SW from the centre of the building towards the wall in the area of pit **1015**. There is a group of stakeholes along the SE edge of the channel and it is abutted on the W by stone setting/pier **996**.

197. B206, Period 3b, Type 3.
Built along the N edge of plaster floor **744** and abutting wall **168** is a type 5 wall constructed of mud and fairly regular sized stones with pebble snecking stones. It is set on a mud base with no foundation and is only one stone wide. Both faces are rendered in a white clay plaster 0.03m thick.

926. 927, Period 4, Type 2.
A distinct U-shaped groove running in a straight line NNW-SSE defines the W boundary of surface 927. It is 2.05x0.03-0.07x0.02-0.05m.

963. B855, Period 3b, Type 1.
A low ridge constructed of compact yellow/white clay with small stones and sherds, 3.0x0.10x0.08m, on floor **1700** runs from the NE corner of hearth **951** to meet wall **831** below the basal stone course where the wall sits on a slight terrace. There is one possible stakehole in the top of the ridge and there is some evidence for a second ridge to the S.

991. B4, Period 3b, Type 1/3?
Two channels running along the N (1.03x0.40x0.22m) and W (2.20x0.20x0.20m) edges of the plaster floor are packed with small stones, some set on edge, in a matrix of fairly loose, grey ash and

silts. The internal structured layers of the plaster floor dip away from the channel indicating that the floor was laid against them.

1074. B2, Period 3b, Type 1?

Lying along the N edge of plaster floor **389** is a very irregular channel c4.80m long with a line of c10 cobble sized stones set end to end in its W part below the level of the floor. A similar channel may be represented by a few stones set along the W edge of the floor. Small finds: KM745, 2362.

1522. B1016, Period 3a, Type 1.

A single row of small stones, c0.10x0.08x0.07m, set edge to edge on a mud base runs along floor **1026** NE from the corner of hearth **1520** and almost reaches wall **1004**. The ridge is 2.50x0.13x0.10m and is not straight but has a slight inward curve. The plaster floor of the building curves up to meet the ridge although the ridge itself is not plastered.

1524. B1016, Period 3a, Type 1.

A line of stones set edge to edge 1-2 stones wide on a base of reddish/brown mud runs along floor 1026 SE from the corner of hearth **1520** to meet wall **1004**. There are traces of plaster similar to the lime plaster on the floor on parts of the ridge.

1548. B1547, Period 3a, Type 1.

A low mud ridge, 2.19x0.20x0.12m, which is rectangular in section runs NE from the centre of the building to the wall where it splays out slightly. It is constructed entirely in a fine, whitish (havara?) clay with no stones. Pit **1588** cuts it at the centre of the building and floor **1552** to the NW builds up in layers against the ridge.

1567. B1565, Period 3a, Type 1.

A fragmentary ridge, 0.87x0.17x0.06m, constructed of a compact, granular white "plaster" set around a core of cobbles and pebbles sits on floor **1558** running N/S. Later floors to the E run up to and abut onto the ridge.

1572. B1547, Period 3a, Type 1.

A rectangular sectioned, flat topped ridge constructed entirely of a fine, whitish hard havara mud plaster, 2.52x0.26x0.12m, runs SE from pit **1588**, which cuts it, to the E jamb of the doorway where it splays out slightly.

A1.6 Basins.

103. B98, Period 4, Type 1.

A very shallow semi-circular scoop, 0.87x0.50m, appended to the SW exterior wall of the building with a 0.80m wide rim and lined with a havara plaster.

112. 109, Period 4, Type 1.

Preserved as a semi-circular depression, 1.90m dia, luted with a clay plaster and with a smaller inner depression 0.40 dia x 0.26m. There is a concentration of ash in and around the feature.

114. post **B86,** Period 4, Type 1.

A shallow oval depression, 1.48x0.96x0.19m, luted with havara clay.

115. post **B86,** Period 4, Type 4.

A deep basin, 0.17 dia x 0.16m, luted with a hard white "plaster", possibly lime plaster.

116. Period 4, Type 1?

A fragment of a clay basin or ceramic-like vessel in a secondary/eroded position. Only the base and part of the walls survive, 0.24x0.20x0.08m.

190. 137, Period 4, Type 1?

A shallow depression, 0.17 dia x 0.06m, luted with a crumbly white "plaster" and associated with hearth **137**.

191. Period 4, Type 4.

A fairly deep basin, 0.43 dia x 0.19m, luted with a crumbly, silty white plaster and with a slightly projecting rim.

216. B86, Period 4, Type 5.

A fairly deep and straight-sided pit, 0.43 dia x 0.17m, lined with small stones at its base and luted with a very fine, hard, dense lime plaster to give it a round bottomed appearance. On floor **222**.

230. B86, Period 4, Type 2.

A shallow, elongated depression, 1.24x0.40x0.09m, against the NE interior wall face on floor **222** and luted with a coarse crumbly white "plaster". A small ridge runs across its base.

236. B86, Period 4, Type 1.

A shallow sub-oval depression, 0.44x0.29x0.03m, with gently sloping sides lined in a compact, hard reddish/yellow clay laid to create an irregular pocked and edged surface. It is near the centre of the building and is associated wih a quern stone on its E edge and an edge set slab to the N.

409. Period 4, Type 1.

A shallow oval depression, 0.43x0.74x0.06m, lined with a compact nodular white "plaster" 0.01m thick.

634. 322, Period 4, Type 1.

A small circular depression, 0.40x0.34x0.06m, surrounded by pebbles and line with "plaster". It is set into surface **322** between **B376** and **B204**.

643. B200, Period 4, Type 1.

A shallow circular depression, 0.37x0.35x0.11m, lined with "plaster" and set into the exterior surface immediately to the E of the entrance of **B200**. Fragments of a ceramic vessel, <u>KM5578</u>, were found lying inside the basin.

752. B493, Period 4, Type 1.

A small, damaged, circular depression, 0.35 dia x 0.15m, on the floor of the secondary use of the building. Small finds: <u>KM968-9</u> conical stones.

822. Period 4.

No records available.

899. post **B2,** Period 4, Type 1.

A shallow depression, 1.0 dia x 0.15m, lined with a hard, white "plaster".

1033. pre **B3,** Period 3/4, Type 5.

A shallow, circular depression, 0.44 dia x 0.21m, lined with fist-sized stones and covered with a white "plaster". Two more poorly preserved basin lie just to the N of this. They are all cut into surface **866** below **B3**.

1133. B1052, Period 4, Type 1.

A shallow, sub-oval depression, 0.48 dia x 0.07m, lined with a hard, brownish "plaster" and containing a large socketed stone <u>KM5028</u>. Cut into floor **1194**.

1148. B1044, Period 4, Type 1.

A shallow depression, 0.43x0.35x0.13m, lined with a yellow/white "plaster". To the W, at right angles to the basin, sits a large quern, KM5024, set up on several smaller stones. The basin is cut into floor **1171**.

1196. B3, Period 4, Type 1.

A small, worn, shallow, circular depression, 0.32x0.40x0.05m, lined with a grey "plaster".

1214. B1000, Period 3b, Type 2.

A double basin complex construced in the NE corner of the building as an integral part of the floor. The edges of the basin and the internal dividing ridge are built of small pebbles covered in "plaster" and sand 0.05m high. There is no edge to the basin to the W where it is open nor to the S where it has been destroyed by pit **911**. The S basin is 0.85x0.68m, the N basin is 1.03x0.33m, and the ridge is 0.88x0.12m.

1237. B855, Period 3b, Type 2.

A compartmented basin, 1.00x0.80x0.03m, formed from a branching mud plaster ridge into roughly 4 irregular segments, the N segment centred on a stone setting **1296**. An upturned quernstone lies immediatley to the W and a second upturned quern, KM1782, lies just to the N.

1386. post **B1046,** Period 4, Type 1.

A shallow circular depression, 1.20 dia x 0.22m, with a broad flat rim preserved on its W side and lined with a hard, white "plaster". It is siting in eroded material over the building.

1497. B1046, Period 4, Type 1.

A very shallow circular depression, 0.34 dia x 0.05m, set into floor **2000** and lined with "plaster" to stand slightly above the floor surface.

1498. B1046, Period 4, Type 2.

A compartmented basin, 1.18x0.85x0.15-0.20m, divided into 6 segments set into floor **2000** in the S of the building. It is formed from fragile mud ridges with small stones placed at intervals along it. Five segments run N/S parallel to each other and the sixth runs E/W along the base of these. The floors of the basins vary in depth from each other and the entire feature has been finished in a fine "plaster" coating.

1536. B1016, Period 3a, Type 5.

A basin, 0.45 dia x 0.15m, set against the W wall of the building and constructed of the base sherds of a ledge-footed vessel sitting on stones set in a cloddy, white "plaster" in a shallow pit around a large flat stone. The sherds are covered in the "plaster", which is 0.15m thick, but have been allowed to project above the floor surface. Small finds: KM3024 flat stone, KM5526 vessel

1559. B1565, Period 3a, Type 4.

A large deep pit, 0.50x0.95x0.36m, against the E wall of the building within an area bounded by mud ridges. It is lined with "plaster" 0.07m thick containing some small pebbles and there are a few larger stones set around the N edge of the pit. It has been re-lined with stones and a "plaster" which is burnt orange. A CW vessel rests on stones in the fill directly over this.

1584. B1547, Period 3a, Type 1.

A basin, 0.62x0.56x0.12m, lined with a hard, white, nodular "plaster" and set into the top of an irregular subcircular pit 0.22m deep which is itself filled with friable "plaster" and cobbles. One stone protrudes through the base of the basin. The basin sits directly to the NW of hearth **1604** and appears to have been replastered on at least one occasion. Small finds: KM3218 pot disc, KM3219 bone needles.

1588. B1547, Period 4, Type 1.

A large pit, 1.16x1.12x0.18m, lined with "plaster" which is preserved along the N rim only. The pit sits at the centre of the building and cuts the two ridges **1548** and **1572**. Small finds: KM3226 semi-pierced sherd.

2013. B1046, Period 4, Type 2.

A poorly preserved basin complex built of a narrow "plaster" ridge set into floor **2000** against the SW wall. The basin, 0.90x0.80x0.15m, is set into a broad shallow pit 0.12m deep wih ridges set around the rim to give greater depth to the basin. The ridge is reinforced with small pebbles set at intervals and there is some evidence of internal divisions. Small find: KM2491.

2015. B1046, Period 4, Type 2.

A basin complex set into a shallow pit 0.08m deep with narrow "plaster" ridges built around the rim of the pit. Two smaller compartments are locaed inside the main basin. The ridges are reinforced at intervals with small pebbles and appears to be built onto the N side of basin 2013 against the N wall of the building. 0.90x0.80x0.15m.

2069. B1161, Period 3b, Type 4.

A conical shaped pit, 0.38 dia x 0.18m, lined with "plaster" at its base and set into floor **1300**. The material of floor **1300** forms a rim to the pit although there is a 0.07m gap between the rim and the "plaster" inside the pit. The pit has been partially filled with small irregular pebbles and is built over oven **1275**.

2115. Period 3a/b, Type 1.

A shallow pit, 0.72 dia x 0.14m, lined with a mud and havara nodule plaster and cut into surface **2126** E of **B2**.

2129. Period 5, Type 5.

Stone setting **2103** consisting of an oval formation of edged stones containing a paving of small irregular stones with, at its centre, a hollow created by angled stones lined with havara plaster forming a basin 0.40 dia x 0.20m. directly adjacent is a second stone setting **2133**.

A1.7 Stone Settings.

11. B1, Period 4, Type 5.

Broken quernstone, KM351, set on sedge in small pit to SW of hearth **10**.

70. Period 4, Type 1.

Oval arrangement of stones and sherds set into a compact havara surface. 0.65 dia x 0.05-0.10m.

92. B86, Period 4, Type 4.

Arrangement of edge set stones sitting in a slight depression at a point beside entrance 202 where the inner facing stones of the wall have been removed. Floor 90 runs up against the stones and there are traces of "plaster" in the base of the feature. 0.32x0.36x0.29m.

111. B96, Period 4, Type 2.

Arrangement of 5 edge set stones around a flat slab all lined with a clay plaster now heavily eroded. Set against the inner wall face of the building. 0.40m dia.

415/422. B200, Period 4, Type 1.

Two irregular shaped pits defined by gaps in the paving slabs of floor **390**. (**415**: 0.36m dia x 0.16m) (**422**: 0.25x0.24x0.20m).

431. B200, Period 4, Type 1?

Large central pit defined by a circle of stones forming part of the floor paving **390**. The base of the pit is also paved with flat slabs. 0.70x0.68x0.22m. Small finds: KM802-4.

718. B3, Period 4, Type 4.

Elongated, deep oval pit, 0.80x0.60x0.31m, with rounded base and stones set almost continuously around the upper edge. A rubber on the S edge is set up on 3 courses of sherds. Small finds: KM930 rubber, KM1237 pestle, KM1838, also another quern and flint cores all set around the rim.

719. B3, Period 4, Type 4.

Large, oval, round bottomed depression, 1.0x0.80x0.25m, with stones set along W and NE edges. There is a ridge of mud and stones to the SW beside **720**. Small finds: KM1234-6.

720. B3, Period 4, Type 4.

Sub-circular discontinuous ring of stones 0.60x0.52x0.09m, bounding a slight depression in the floor forming a ridge of mud plaster and stones. Setting for vessel **711** still *in situ*. Small finds: KM1430-1 pounders.

721. B3, Period 4, Type 4.

Small sub-circular shallow depression, 0.58x0.52x0.17m, with rounded bottom and "plaster" along its N edge. There is a mud and stone ridge around the rim with one stone on W angled into pit. Small finds: KM1232 pestle.

723. B3, Period 4, Type 4.

Large, shallow, sub-circular depression, 0.82x0.80x0.19m, with one large stone on W edge and a flat, wide base. Setting for vessel **374**.

724. B3, Period 4, Type 4.

Circular, partially "plastered" shallow pit, 0.60x0.56x?m, with symetric profile and stones set discontinuously around the rim. Setting for vessel **351**.

726. B3, Period 4, Type 4.

Shallow depression, 0.54x0.50x0.20m, ringed with stones on the E and with two large flat slabs on the W. The S one of these, **725**, is a large, flat, pierced slab. Four rounded pebbles are set into the base of the depression and the whole arrangement is constructed into a mud bank along the N wall of the building.

759. B494, Period 4, Type 1.

A roughly rectangular seting formed from 3 boulders on 3 sides, 0.60x0.53m. a stone lid, KM1046, and a pebble lie within this area.

760. B494, Period 4, Type 1.

Arrangement of 5 edge set stones (max 0.15m long) lying along the W and S sides of a circular pecked limestone slab, KM1036. A reddish/brown coarse grained soil overlies this slab. 0.40x0.37m. Small finds: KM1036 slab, KM1037 adze.

795. B3, Period 4, Type 1.

Arrangement of 3-4 stones, 0.53x0.78m, set into a mud bank along the N wall of the building. The S stone may be displaced giving an exaggerated N/S dimension. The sherds of a large vessel are still *in situ* c0.10m below the rim of the setting.

806. Period 4, Type ?

Arrangement of stones 1 stone wide in a matrix of ashy soil with nodules of burnt daub and "plaster" flecks. No clear description available. 0.93x0.56m.

824. B3, Period 4, Type 2.

Arrangement of a single irregular shaped stone placed flat with two edge set stones on its SE and NE sides both with a 0.25m thick layer of "plaster" on their inner face. 0.26x0.24m.

836. B3, Period 4, Type 1.

Roughly circular arrangement of stones 0.22m below neighbouring stone **725** on the edge of the mud bank along the N wall of the building. It consists of 3 irregular stones on W, pestle KM1084 and rubber KM3133 on the S, 3 stones on the E and 5 stones including a rubber along the N. Setting for vessel 677. 0.90x0.87x0.20m. Small finds: KM505, KM1026, KM1804 pestle, KM1082 pot lid, KM3133 rubber.

840. B3, Period 4, Type 4.

A slight depression, 0.68 dia x 0.17m, flanked by 3 stones on its E and S sides Probable setting for vessel **711/716**? Small finds: KM2003.

845. B3, Period 4, Type 1.

Arrangement of 4 medium sized limestone blocks set on a c0.05m thick plinth of mud, 0.70 dia x 0.09m. It defines the N and W sides for setting of vessel **407**.

850. B3, Period 4, Type 4.

Arrangement of irregular shaped stones around the W and S sides of a shallow depression set lower than adjacent **720**. Two courses of stones preserved in places. 0.70x0.68m.

1133. B1052, Period 4, Type 3.

Large socketed stone, KM5028, set in "plaster" basin **1133** in W of building beside entrance in lower floor **1194**.

1136. B1052, Period 4, Type 1.

Arrangement of stones and artefacts in a roughly circular setting partially overlying **1137** and socketed stone KM5027 to the E of the entrance. 0.70 dia x 0.02m. Small finds: KM1873-7 worked stones/pebbles.

1162. B1052, Period 4, Type 1.

Arrangement of rounded stones in a roughly circular setting against the E wall and associated with a potspread. 0.70x0.40x0.10m.

1176. B1052, Period 4, Type 3.

Setting of flat stones including 2 quern fragments against the E wall of the building on secondary floor **1174**. 0.60x0.44x0.17m. Small finds: KM1168-9 axes, KM1727-8 quern frags, KM1729 worked stones, KM1867 pounder, KM1872 axe, KM1881 axe.

1332. Period 4, Type 1.

Arrangement of stones around decayed, dished calcareous stone set in a slight hollow, 0.46x0.40x0.15m, and partially "plastered". Adjacent to 1335.

1335. Period 4, Type 3.

Socketed stone lying E of **1332**. 0.35x0.30x0.15m.

1343. B834, Period 4, Type 1.

Arrangement of small irregular shaped stones in a circular setting, 0.45x0.44x0.12m, on floor **1228** in E part of building. Small finds: 2 conical stones.

1352. Period 3/4.
No description available.

1378. Period 4, Type 3.
Large quern, KM2307, set upon a small platform of pebbles and larger stones packed together but not bonded with mud. It sits upon surface **1380** and is cut by **Gr515**. 0.68x0.43x0.20m. Small finds: KM2307 quern, KM2691 limestone bowl.

1509. B1016, Period 3a, Type 2.
Loosely packed arrangement of stones with ashy yellow/black soil and concentrations of sherds. An oval stone setting forming the base of an earth ring sits at the W edge of the stones and partially overlies the SE corner of hearth 1520. This is associated with burnt sherds and the whole feature has been badly damaged by ploughing. 1.80x0.65x0.20m. Small finds: KM2063, 2125, 2257-8.

1693. B1165, Period 4, Type 5.
Edge set quern stone between hearth **1359** and doorway, set into the plaster apron of the hearth, **1420**.

1694. B1295, Period 3b, Type 5.
Edge set stone to SE of hearth **1294**.

1684. B1044, Period 4, Type 5.
Edge set stone between hearth **1041** and doorway **1060**.

1686. B1046, Period 4, Type 5.
Edge set stone between hearth **1495** and doorway **2017**. The top face of the stone has been heavily pecked and chipped.

1689. B1052, Period 4, Type 5.
Edge set stone between oven **1070** and doorway **1135**.

1699. B834, Period 4, Type 5.
Edge set stone between hearth **1250** and doorway **1254**.

1704. B1547, Period 3a, Type 5.
Cuped stone, KM5006, and a small flat stone set on edge one behind the other beside floor division **1572** in from the doorway **1605**.

1706. B855, Period 3b, Type 5.
Edge set stone lying to the NW of hearth **951** and basin **1237**.

1707. B98, Period 4, Type 5.
Edge set quern stone lying between hearth **124** and doorway **1702**.

2140. B3, Period 4, Type 3.
Flat stone set into slight depression inside E jamb of doorway on floor **695** with a small edge set stone between it and the wall of the building. It is surrounded by stakeholes. 0.29x0.24x0.07m.

2141. B3, Period 4, Type 1.
Arrangement of flat and irregular stones with small supportive wedges set against the W wall of the building. Setting of vessel **2137**.

A1.8 Pier/Bench.

299. **B4**, Period 4, Type 3.

A short stretch of 4 stones laid in a row with smaller stones infill and set directly onto floor **291**. 2.30x0.90x0.29m. An area of earth and "plaster" like a surface lies to the W and links it with a group of stakeholes to the S and feature **300**.

492. **B3,** Period 4, Type 3.

A rectilinear setting of small, closely packed stones 2 courses high with regular faced edges and bounded on the E and W by well defined bands of ash, possibly the remains of burnt timbers. It sits on the eroded destructional collapse of the building with area of burnt mud to the NE and SW as well as other stretches of burnt timbers. 1.30x0.94x0.06m.

635. **B376,** Period 4, Type 2?

A patch of cobbles laid against the exterior SW wall of the building directly onto surface 293 and associated with a "plastered" depression immediately to the W. 1.20x0.60x0.10m.

996. **B994,** Period 3b, Type 3.

A rectilinear arrangement of stones fairly roughly laid with larger stones to the outer faces and smaller stones bonded in mud forming the core. It sits at the centre of the building but on thin primary deposits overlying the floor. 0.90x0.50x0.15m.

1137. **B1052,** Period 4, Type 1.

Platform or bench of 2 flagstones set in "plaster" one beside the other and projecting at right angles from the interior N wall of the building. The E flagstone is an inverted quernstone placed over **Gr542**. 1.10x0.95x0.14m. Small finds: KM1954 worked diabase object.

1518. **B1016,** Period 3a, Type 3.

Rectilinear arrangement of large stones (c0.30x0.25x0.15m in size) 2 courses high and closely packed together. It overlies floor **1508**, hearth **1520** and ridge **1522** and runs E/W with an overall size of 1.40x0.45x0.30m. Small finds: KM2090 bone needle.

1534. **B1016,** Period 3a, Type 1.

A roughly square setting of stones set against the inclined orthostats at the base of the wall and slightly overlying ridge 1524. It consists of 4-5 fiarly large slabs set side by side and angled towards the wall defining an area infilled with smaller stones. 1.00x0.60m.

1550. **B1547,** Period 3a, Type 2.

Rubble built but tightly packed band of stones and cobbles 2-4 courses high with an earth infill and running along the SW exterior wall of the building. 2.90x0.35x0.35m. Small finds: KM2876-7 adzes, KM2878 quern.

1709. **B1016,** Period 3a, Type 2.

A short arc of stones set into the foundation cut against the SW wall of the building consisting of 3 large facing stones with smaller stones forming the core. c0.90x0.30m.

0000. **B1000,** Period 3b, Type 1.

Two short lengths of mud and stone piers projecting from the NW interior wall of the building, both very badly damaged and not surviving for any great height. c0.65x0.30xc0.10m.

A1.9 Postholes.

22. **B1**, Period 4. In surface 17. 0.45 dia x 0.25m.

23. **B1**, Period 4. In surface 17. 0.20x0.40x0.20m.

59. **57**, Period 4. In surface 57. 0.16 dia x 0.10m.

62. Period 3/4. Squarish in shape. 0.14 dia x 0.10m.

93. **B86**, Period 4. In floor 222 at position of pivot stone. 0.24x0.32x0.20m.

142. **139**, Period 4. Group of 15 postholes in 2 parallel lines in surface **139**.
142.1 0.12 dia x 0.09m.; **142.2** 0.06 dia x 0.14m; **142.3** 0.06 dia x 0.12m.; **142.4** irregular x 0.05m.; **142.5** 0.06 dia x 0.07m.; **142.6** 0.05 dia x 0.055m squared.; **142.7** small and irregular.; **142.8** 0.08x0.05x0.05m.; **142.9** irregular.; **142.10** 0.14 dia x 0.15m.; **142.11** irregular.; **142.12** 0.15 dia x 0.15m.; **142.13** 0.06 dia x 0.15m.; **142.14** indefinite x 0.175m.; **142.15** indefinite x 0.12m.

145. **B96**, Period 4. Shallow scoop with ph to side. 0.13 dia x 0.20m.

198. **164**, Period 4. In pit **164**. 0.20 dia x 0.08m.

223. **B1**, Period 4. At edge of floor. 0.20x0.30x0.25m.

235. **B200**, Period 4. In floor 3. 0.11 dia x 0.09m.

236. **B200**, Period 4. In floor 3. 0.22x0.17x0.17m.

241. **B1**, Period 4. Well defined vertical cut on N edge of floor. 0.19 dia x 0.18m.

247. **B1**, Period 4. Well defined verticla cut on N edge of floor. 0.22x0.17x0.26m.

248. **B1**, Period 4. Small, vertical cut. 0.08x0.07x0.08m.

249. **B1**, Period 4. Small, vertical cut. 0.13x0.10x0.12m.

266. **B375**, Period 4. In surface **150**. 0.15x0.19x0.19m.

267. **B375**, Period 4. In surface **150**. 0.30x0.17x0.14m.

268. **B375**, Period 4. In surface **150**. 0.19 dia x 0.18m.

269. **B375**, Period 4. In surface **150**. 0.12x0.11x0.25m.

270. **B375**, Period 4. In surface **150**. 0.18x0.14x0.19m.

271. **B375**, Period 4. In surface **150**. 0.15x0.16x0.21m.

272. **B375**, Period 4. In surface **150**. 0.14x0.15x0.23m.

273. **B375**, Period 4. In surface **150**. 0.15x0.12x0.29m.

274. **B375**, Period 4. In surface **150**. 0.21x0.17x0.12m.

275. **B375**, Period 4. In surface **150**. 0.12x0.13x0.22m.

290. **B2**, Period 3b. Against inner face of wall in floor **389**. 0.21x0.18x0.15m. Seventeen other posholes and stakeholes across the floor.

316. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.20x0.13x0.09m.

317. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.13x0.10x0.09m.

318. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.13x0.10x0.03m.

319. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.11x0.10x0.09m.

325. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.09x0.08x0.06m.

327. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.05 dia x 0.07m.

328. **B2**, Period 3b. Timber lean-to against wall of **B2**? 0.27x0.16x0.16m.

356. **706**, Period 4. Above **B200**. 0.27x0.18x0.30m.

397. **B4**, Period 3b. In surface **497**, declined 70 degrees to SE. 0.16x0.27x0.20m.

398. **B4**, Period 3b. In surface **497**, declined to S. 0.12x0.11x0.22m.

439. **B86**? Period 4. 0.230x0.26x0.40m.

469. post **B494**, Period 4. 0.15 dia x .11m.

482. **B204**, Period 4. In floor **377**. 0.18x0.12x0.10m.

489. **387**, Period 4. In surface **387**. 0.22 dia x 0.10m.

658. **B493**, Period 4. Post occupation in shell of building set inside slightly larger shallow pit. 0.13 dia x 0.20m.

742. **164**, Period 4. In surface **164** over **B206**. 0.18x0.14x0.37m.

751. **654**, Period 4. In quarry complex **654**. 0.34x0.31x0.40m with a small 0.10m deep hole at base.

756. Period 4. Above **B206**. 0.26x0.16x0.12m.

757. Period 4. Above **B206**. 0.14x0.12x0.12m.

807. **803**, Period 4. In surface **803** contemporary with **B3**? 0.25 dia x 0.17m with a small hole, 0.10 dia x 0.05m, at the base.

808. **803**, Period 4. In surface **803** contemporay with **B3**? 0.22x0.12x0.09m.

809. **803**, Period 4. In surface **803** contemporary with **B3**? 0.20 dia x 0.18m.

810. **803**, Period 4. In surface **803** contemporary with **B3**? 0.21x0.17x0.26m.

811. **803**, Period 4. In surface **803** contemporary with **B3**? 0.21x0.18x0.26m.

864. Period 4. Cuts wall **197** of **B206**. 0.20x0.13x0.11m.

1021. **B206**, Period 3b. Massive stone packed pit with large posthole in centre. Width of post pipe is c0.33m. The lower 0.25m of the pit is backfilled with a soil. 1.00 dia x 1.34m.

1055. **B994**, Period 3b/4. Cut into floor **983** of building but contains period 4 sherd. 0.18x0.16x0.43m.

1056. **B994**, Period 3b/4. Cut into floor **983** of building but contains period 4 sherd. 0.30x0.25x0.23m.

1059. Period 4. Large, fairly shallow pit, 0.65x0.75x0.36m, filled with ash and heat cracked stones with a clay surface in its upper level containing a posthole cut into it.

1120. above **B834**, Period 4. 0.05x0.06x0.12m.

1127. **B866**, Period 4. In floor **1118**. 0.11x0.12x0.14m.

1129. **B866**, Period 4. In floor **1118**. 0.12 dia x 0.10m.

1197. **B206**, Period 3b. In hearth **1182**. 0.18x0.20x0.19m.

1203. **B994**, Period 3b. A straight sided flat bottomed ph in floor **983**. 0.16x0.18x0.13m.

1204. **B994**, Period 3b. A tapering sided and round bottomed ph in floor **983**. 0.24x0.25x0.33m.

1221. **B834**, Period 4. In pit **1217** cut into patchy floor 2 surface. 0.12x0.08x0.12m.

1224. **B994**, Period 3b. In floor **983**. 0.07 dia x 0.07m.

1245. 1239, Period 3b. In surface **1239** (ceremonial area) over **B2**. 0.14x0.13x0.22m.

1246. **1239**, Period 3b. In surface **1239** (CA) over **B2**. 0.13x0.12x0.16m.

1247. **1239**, Period 3b. In surface **1239** (CA) over **B2**. 0.10 dia x 0.11m.

1259. **B1052**, Period 4. A very deep tapered ph in floor 1. 0.30x0.21x0.67m. 0.15m at base.

1260. **B3**, Period 4. In floor **695** in NW of building. 0.08x0.10x0.17m.

1303. Period 3b/4. Above surface **1277**. 0.27 dia x 0.30m.

1402. **B834**, Period 4. In surface **1385** outside entrance. Porch? 0.19x0.16x0.36m.

1403. **B834**, Period 4. In surface **1385** ouside entrance. Porch? 0.38x0.17x0.19m.

1404. **B834**, Period 4. In surface **1385** outside entrance. Porch? 0.17 dia x 0.26m.

1405. **B834**, Period 4. In surface **1385** outside entrance. Porch? 0.23x0.19x0.17m.

1407. **B834**, Period 4. In surface **1385** outside entrance. Porch? 0.22x0.17x0.20m.

1413. **B834**? Period 4. In surface **1392** E of building. 0.29x0.20x0.13m.

1424. **B834**, Period 4. In surface **1385** outside entrance. Porch? 0.20x0.15x0.21m.

1431-1459, 1470-2, 1476. **B1165**, Period 4. In floor **1166** and on hearth apron **1420**.

1431 0.14x0.12x0.13m vertical; **1432** 0.06 dia x 0.08m declined to N; **1433** 0.14x0.11x0.10m vertical; **1434** 0.12x0.10x0.06m; **1435** 0.09x0.07x0.07m; **1436** 0.08 dia x 0.05m; **1437** 0.13x0.12x0.10m; **1438** 0.09x0.06x0.10m; **1439** 0.14x0.13x0..09m KM2471; **1440** 0.16x0.15x0.08m; **1441** 0.10x0.07x0.09m; **1442** 0.10x0.08x0.08m in entrance associated with stakeholes; **1443** 0.10 dia x 0.09m in apron 1420; **1444** 0.10x0.12x0.08m double ph in apron 1420; **1445** 0.10 dia x 0.12m in apron 1420; **1446** 0.10 dia x 0.10m in apron 1420; **1447** 0.15x0.12x0.12m D-shaped; **1448** 0.10x0.08x0.07m one side sloped; **1449** 0.12x0.10x0.06m; **1450** 0.04 dia x 0.08m declined to N; **1451** 0.07x0.065x0.09m; **1452** 0.06x0.05x0.05m; **1453** 0.035x0.025x0.04m very slight; **1454** 0.35x0.02x0.04m very slight; **1455** 0.09 dia x 0.12m in apron 1420; **1456** 0.16x0.14x0.12m small pebbles at base; **1457** 0.15 dia x 0.10m; **1458** 0.06 dia x 0.08m declined to N; **1459** 0.15x0.10x0.10m; **1470** 0.08 dia x 0.12m; **1471** 0.08x0.07x0.12m; **1472** 0.15x0.12x0.17m; **1476** 0.05 dia x 0.06m.

1654. **B1547**, Period 3a. In entranceway. 0.12x0.10x0.05m.

1673-6. Period 2. Below surface **1570**.

1673 0.15 dia x 0.14 tapered sides; **1674** 0.34x0.26x0.24m; **1675** 0.28x0.25x0.10m pebble filled; **1676** 0.28x0.20x0.27m.

1678. **1667**, Period 2. At base of pit complex **1667**. 0.29x0.27x0.26m.

2023. **2021**, Period 3a. In surface **2021**. 0.20 dia x 0.27m.

2026-9. **B1046**, Period 4. In floor **2000**. **2026** 0.13x0.10x0.10m; others unexcavated.

2031. **B1161**, Period 3a. Contemporary with **B1161**? 0.08 dia x 0.18m. Small find: KM2565.

2118. **2116**, Period 3/4. In surface **2116**. 5 phs ave 0.16 dia x max 0.20m.

2145-51. **B1103**, Period 3b. In floor **1192**.

2145 0.12x0.13x0.09m declined to W; **2146** 0.10x0.13x0.15m declined to S; **2147** 0.20x0.18x0.19m; **2148** 0.18x0.15x0.16m; **2149** no data; **2150** 0.20x0.17x0.09m stoney base; **2151** 0.19x0.11m.

A1.10 Stakehole Groups.

21. B1/B98, Period 4.

A group of 16 stakeholes defining a circle 0.60m across. All are vertical and vary from 0.03-0.08m dia. They are set into a surface, 17, outside the two buildings to the S and are associated with other stakeholes.

60. **B3** Period 4.

Alignment of 4 stakeholes 0.03-0.05m dia x 0.05-0.09m deep set around pit **58** to the S of **B3**.

113. B1/98. Period 4.

Various scaters of stakeholes to the S of the buildings.

201. **B2**, Period 3b.

Alignment of 6 stakeholes in floor **131** set c 0.10-0.15m apart. Ave dia c0.05m.

276. Period 4.

Random arrangement of 25 stakeholes in surface to N of **B1** associated with 2 postholes. Ave dia c0.03m.

280. **B86**. Period 4.

Concentration of 12 stakeholes in 2 groups, one near the entrance of the building and the second near the centre.

314. **B4**, Period 3b.

A collection of 65 small-large stakeholes arranged over the 2 intact floor surfaces of the building. One group in the NE part does no appear to be in any discernible pattern although several may encircle pit **313** and there is a regulary spaced setting of larger stakes along the perimetre of the floor at the base of the wall. There is a noticeable doubling of similar sized stakeholes as if the pattern were deliberate and had been replaced on at least one occasion.

A second group is set into the plaster floor **291** and the hearth **990** and must have been an integral part of the floor construction. It consists of a fan-shaped setting of vertical stakes with stone setting **299** forming one arm of the fan. A smaller group of stakes within this arrangement is all declined sharply to the SW.

329. **B1328**. Period 3b.

A semi-circular setting of stakeholes beneath(?) floor **292** defining an area of c0.50m dia. It is incompletely excavated.

399. **B4**. Period 4.

A series of sakeholes in the W-central part of the building set into surface **497** in no apparent pattern.

603. **B204**? Period 4.

A dense concentration of stakeholes in surface **387** to the N and W of the building. Many are contemporary with **B204** but the presence of some below wall **194** suggests that **603** as seen is probably a palimpsest. Some circular and linear arrangements are discernible.

821. **877**. Period 4.

A dense concentration of stakeholes, ave dia 0.03-0.05m x 0.11m deep, in surface **877** overlying **B855**. Some stakeholes are "lined" with clay and others have a charcoal fill.

1023. **B994**. Period 3b.

A scatter of stakeholes set into floor **983**. There is a possible arrangement of 5 around stone vessel KM5065 and a roughly linear arrangement in a slight gully running radially from the centre of the building N to the wall over **1015**.

1346. **1347**. Period 4.

A roughly linear arrangement of 7 stakeholes in surface **1347** to the E of **B834**.

1399. **B834**. Period 4.

A group of 26 stakeholes, 0.01-0.05m dia, set into surface **1393** in front of the entrance to the building. A small group is immediately in front of the entrance and the rest are c0.80m further to the S although none appear to either side of the entrance.

1627. **1629**. Period 3a.

Two stakeholes cut into surface **1629**, 0.05m dia x 0.15m deep. One is possibly later and both are associated a pit and a stone pestle.

1648. Period 3a.

Two stakeholes and a shallow posthole in a line set into general layer **1570**. (0.06x0.05x0.09m) (0.10x0.07x0.11m) (0.017x0.16x0.08m).

2030. **B1046**. Period 4.

An arc of 34 stakeholes in floor **2000** immediately in from the entrance and stretching over to plaster basins **2013** and **2015**. There is no apparent pattern.

2083. Period 3a.

A group of 11 stakeholes on either side of a low "plaster" ridge just SW of **B1295** and near oven **1486**. 0.04-0.10m dia x 0.06-0.11m deep.

2106/2125. Period 3/4.

A group of c12 stakeholes probably of different periods set into surfaces to the E of **B2**. There is a convincing arrangement of 6 around pit **2107**. The best preserved are 0.06m dia x 0.10m deep.

Appendix 2: Ethnoarchaeology

How I envey them their shovels and sieves and tape measures,
all their tools, and their wise, expert hands that touch and hold what they find!
Not for long; they'll give it to the musuem, of course,
but they did hold it for a moment in their hands.

Always Coming Home
Ursula leGuin, 1985, 3

A2.1 The methods of research.

The use of analogy in archaeology has a long and honourable history which stretches back to the very origins of archaeology as a modern discipline. When confronted with the remains of a material culture in the form of artefacts and monuments which find no echoes in modern society, archaeologists have turned elsewhere to find an explanation through patterns of behaviour, production and use of artefacts or traditions of housing, ceremony and iconography which could provide a framework within which the past could also be understood. By far the greatest application of analogy is by comparison with primitive societies which have been recorded over the past few centuries in various parts of the world or with aspects of the more recent past of our own societies. Anthropology has its own set of criteria as a discipline but there are various aspects of it which are relevant to archaeology and some which are peculiar to archaeology alone. These are covered below. Early uses of analogy through anthropological parallels were frequently inexact and eclectic drawing on material from a wide range of societies from many parts of the world and over a broad time span. This approach had as its core the belief that all human societies and behaviour existed within a common set of natural laws and constraints which produced common responses at all times and in all places. Both Hodder (1982) and Orme (1981) trace the origins of this approach and highlight the unease with which it is viewed by archaeological attitudes stemming from the advent of the "new" archaeology in the 1970s which specified a more rigorous and exact discipline. Although the excesses of the new archaeologists with their emphasis on treating human society as an efficient, well-oiled system has now largely passed, there is still some reaction to the use of anthropology in archaeology. It is, however, unfounded and probably emerges from a lack of understanding of how anthropology can be used. Archaeology always has and always will have at its core the use of analogy as a primary tool of interpretation and understanding. This tool is frequently not made explicit; for example, the identification of certain Neolithic stone artefacts as axes is only made by analogy with observations of modern primitive use, but it does permeate all archaeological thinking and data recovery.

Archaeology has been charged with being an "inexact science" and its methods with being unscientific. These accusations are frequently levelled from outside the discipline by those who misunderstand or are ignorant of the aims and methods of archaeology. Clearly, there is much that is inexact and unscientific in archaeology; that is in the nature of our evidence, but it does not exclude a rigorous and analytical approach which is the particular science of archaeology. It also allows the experience and contribution of non-science based approaches, such as art or architectural history for example, to be considered. Hodder (1982, 16-27) very neatly identifies this approach in his discussion on the use and value of analogy in archaeology in which he has shown how an hypothesis can be supported by considering aspects of relevance, generality and goodness-of-fit between the hypothesis and various conflicting analogies. His argument refutes Binfords (1967) proposition that analogies, and hence hypotheses, can be tested by independent predictions of other relationships. Hodder suggests that in archaeology an hypothesis can neither be proved nor disproved and can only be substantiated through a series of formal and relational links. Formal links are those which establish common aspects between archaeological and ethnographic material; the greater the number of formal links the greater the probability of the validity of the comparison. Relational links identify either a natural link or a direct historical progression between the archaeological and the ethnographic material and are only appropriate when applied in the area of study. These both establish the relevance of the analogy. This can be strengthened by considerations of generality which seek to identify a common basis for the analogy throughout other unrelated cultures and times. Finally, goodness-of-fit establishes the number of similarities between the object and the analogy. Hodder's approach does satisfy certain scientific criteria of being rigorous and impartial without anticipating the outcome of the study. He also highlights the difficulty which is faced in archaeology of not being able to prove a proposition or hypothesis and steers a course towards a more acceptable outcome based on probability. It is this approach which will be followed in the present study.

Orme (1981) divides the application of anthropology in archaeology into five categories. The first category he calls Piecemeal parallels in which analogies are drawn from many disparate sources and is the most common form of usage of anthropology in archaeology. Ethnohistory is a more recent development and is applied mainly in those areas of research where written records of vanished societies do exist. The Americas figure greatly in this approach as a direct result of the more recent history of that country. Ethnographic background studies range over a wide spectrum of parallels and analogies and attempt not so much to provide a specific predictive model as to establish a background to the sort of behaviour and artefacts associated with a particular field of study. Closely associated with this latter approach is Comparative study and synthesis which draws on the analytical nature of anthropology to generate models. The most recent area of anthropological development in archaeology has been rather inelegantly christened Ethnoarchaeology or living archaeology and is the study of existing societies from the point of view of understanding the archaeological deposits and remains they create during the course of the life and activities of the community. Orme has suggested that ethnoarchaeology must be concerned with living communities and their material culture with an emphasis on the behavioural aspects of human society. Manhire *et al* (1985), however, caution against the reconstruction of the past using only historic or contemporary ethnography which they view as "...the end point of a trajectory of change." They advise, rather, the application of a "...two way interaction of ethnography and archaeology...with one equally informing the other." (*supra*, 174). This is a sound and prudent course of action which, if applied sensibly and with due caution observed with regards to circularity, can provide a balanced and mutually strengthened argument. Gorecki (1985) goes further and argues that all ethnographic studies must take account of the time factor and accommodate their data to the wide ranging effects of post-depositional changes. His work suggests that most sites will undergo major changes within five years of abandonment which stabilises after fifteen years and may remain in that state for many thousands of years barring further human intervention. Obviously, the precise period of major post-depositional activity will vary between regions and cultures, but Gorecki's work stresses the importance to archaeology of investigating those first crucial fifteen years after abandonment. These are the studies which investigate modern archaeological remains, that is, the material culture of recent traditional societies, in relation to other aspects of archaeology including environmental considerations. The study of site formation processes is one such consideration. This is the approach which has been adopted in the present study of prehistoric buildings.

An analogy is being drawn here between the buildings and processes of site formation of prehistoric sites and those of the recently abandoned villages of Cyprus which have been little affected by man-induced change since their evacuation 35 years ago. Several strong formal links can be established between the two sets of data based on a similarity of building materials, common environmental conditions, function and a broadly similar level of technology. This latter aspect is the most contentious and is reduced in value by the differences in technology which all too obviously do exist. The modern Cypriot peasant, for instance, has access to traction animals, metal tools and a market economy all of which were unknown in Chalcolithic Cyprus. However, a study of the methods of Cypriot house construction and the organisation of society and labour indicates that these aspects may have had very little impact on the construction process apart from facilitating the acquisition of materials (Ionas 1988). In both case study areas the raw source materials, and hence the building materials were identical as was the climate and landscape. Functionally, both sets of traditions sought to satisfy several social criteria of storage, safety, privacy and comfort by enclosing space in a formal building. There can be no clear demonstration of continuity of tradition over the five thousand years which have elapsed between the two periods although there are some remarkable similarities in detail, as for instance, in stone wall construction, roofing, sanitation, water supply, cooking etc. That there is a general link in all mud building construction across the entire Middle East can also be demonstrated both in prehistory and in more recent history, although this most probably reflects common traditions rather than structural similarities. The important point to be made at this stage is that traditional and prehistoric buildings do have common relational links which can make the former valuable for interpreting and understanding the latter. There are even stronger links when considering aspects of site formation. Buildings of similar construction in a similar environment collapse in a similar fashion and form similar deposits. This is the basis of using them for the present study.

Cyprus has a rich traditional architectural heritage. There are many villages which dot the countryside and reflect this past. More recent events on the island leading up to the partition in 1974 have meant the displacement of whole communities from their homes which have stood empty and neglected for 20-30 years. Abandonned villages are now a sad feature of the Cypriot landscape reminding us of the reality of intolerance and, as archaeologists, of the many forces which have operated in society in the past and which are forever hidden from us. They are, however, part of the archaeological history of the island and, as such, have there own story to tell. As a source of information about traditional building practices, building collapse and site formation processes they offer an unrivalled opportunity of investigation which would be foolish to neglect. Several villages in the Paphos area were visited over a number of years with this in mind. I eventually settled on the village of *Souskiou* near Kouklia as the main focus of this research (fig. 1). The village was well placed for its relative accessibility to *Lemba* without being too open to the destructive progress of tourist and developer interests. It is now the case in Cyprus that no area is entirely free from these activities although even at *Souskiou* it is still at a fairly low level. The following descriptions and observations emerge from many happy and peaceful days spent at that village.

A2.2 Cypriot Vernacular Architecture.

The recent past in Cyprus has seen many changes as the island has emerged as a dymanic modern society on the world stage. Not the least of these changes has been the almost complete demise of an architectural tradition which stretched back many thousands of years. A testimony to this remarkable tradition is the comfort and familiarity with which many of our older Cypriot visitors walk amongst the reconstructions which we have carried out at the Lemba Experimental Village. To them there are many echoes of the old ways and, no doubt, there are many memories of a time which has not long passed. The stones, soil and plant life of Cyprus have always been the touchstone of this tradition which has evolved and developed in accordance with strong customs, needs and, of course, seasonal changes. But the basic format of that tradition has remained constant and has drawn its enduring strength from old and tested ways. It is for this reason that so much valuable archaeological information can be obtained from the old buildings and villages.

As with so many ancient traditions which are overtaken by the rapid pace of change in the modern world, much of the vernacular building tradition has vanished with very little attention being paid to its passing or to recovering and preservation its more worthwhile elements. Some work is now being carried out in this field with attempts to save some of the better preserved villages and buildings showing satisfying results. But, it is a sad reflection on modern values that within the space of a few decades, an entire way of life has passed into the hands of the historian and the archaeologist or ethnographer. Little academic attention has been paid to the vernacular buildings of Cyprus. Exceptional in this widerness is the work of Ioannis Ionas whose publication *La Maison Rurale de Chypre (XVIIIe-XXe siecle) Aspects et Techniques de Construction* is a salutory achievement. It is to him that a record of the richness and diversity of the Cypriot house must be attributed. As well as the materials and construction of the house Ionas also gives details about the use of space, the organisation of labour in the construction process and the regional variants of house layout that can be observed.

The Traditional Cypriot House.

Regional diversity in the appearance of houses is quite apparent when travelling about Cyprus. To the casual observer these differences may appear quite significant, an observation which is quickly dispelled when greater familiarity is achieved. The differences are mainly in the styles of materials used and in the type of roofing, both of which are susceptible to local conditions and skills. This situation has lead to houses with a very local flavour which reflect the predominant colour and materials of the area. It was until fairly recently that this was the case when the advent of mass transportation and the industrialisation of building materials submerged these traditions under acres of concrete uniformity.

The basic form of the Cypriot house, as with most vernacular traditions, is quite simple and can be detected in even the most complex looking courtyard house. Most activities and living in this part of the world takes place out of doors making the courtyard an integral part of the house. The actual building was used primarily for storage and refuge during the worst of the winter weather. It was a rectangular single storey structure whose width of c.4.0m was conditioned by the availability of roofing timbers which rarely came longer than this. There was no structural limit as to the overall length of the house although considerations of space and heating usually curtailled this to 2-3 times the width of the house, that is, 8.0-15.0m. The entrance was in the middle of the long side with several windows facing onto the courtyard and a fireplace at one end of the room. A flat or mono-pitched roof surmounted the structure. This type of building was known as the macrinari (Ionas 1988, 47). Larger buildings could be achieved by doubling the width of the macrinari and effectively putting two side by side. The 4.0m roofing timbers were carried across the increased width by support either form a large cross beam resting on two timber uprights or, in wealthier houses, by a stone built arch. The central support arrangement allowed the construction of a double pitched roof. This type of building was known as the dichoro (*supra*). Both types formed the basis of all traditional Cypriot houses and can be seen, in various forms, across the island. As an architectural form the macrinari is enormously flexible. A two storey house is little more than two macrinari placed one on top of the other. Access is always by way of an external door and staircase which may also incorporate a verandah or porch. Ionas describes differing entrance arrangements to the courtyards which reflect local traditions. These range from an open gateway through a simple wall to the more elaborate two storey gatehouse through a clode arched doorway. Again, though, the gatehouse still follows the basic macrinari form but with much higher walls and with the insertion of a well built stone arched entrance. The addition of porches, arcades, staircases and upper storeys serve to elaborate this basic form and create the fascinating courtyard houses which still survive in many of the rural areas of Cyprus today.

Materials and Techniques.

Ionas observes that stone was used as the preferred building material throughout the island although mud brick was used extensively in the cities of Nicosia, Famagusta and Larnaca as well as in the poorer villages (*supra*, 65). Mud brick was a cheaper material in which to build requiring less labour and did not entail the services of a hired mason. This encouraged the use of the material in all parts of the country where it can still be seen side by side with the stone houses and the modern concrete constructions. Stone work was generally of a very high quality with ashlar masonry appearing in even the most humble of dwellings. Several types of very distinct stone work can be identified and these are; ashlar, coursed masonry and rubble wall. Skillful setting of the stone in coursed layers secured with a mud mortar and chippings from the cutting of the stones creates a very strong, durable and visually appealling type of wall. In areas where the stone was of a poorer quality, as for instance in the *Kissonerga* and *Lemba* area, a type of very rough rubble wall was built and covered extensively with mortar in order to prevent the erosion of mud from between the stones. Mud brick was always rendered with a thick mud or lime wash coating for protection although, where it has eroded away, the underlying brickwork can be seen. Local soils were used and were mixed with both long and short straw binders giving large flat bricks. These were created in wooden moulds and allowed to dry in the sun over several days. Firing of bricks in kilns also took place but the majority of mud brick buildings are of sun dried mud. The process of manufacturing these mud bricks could still be observed in Cyprus until the last decade but has now virtually died out. In places, bricks of very different colours can be seen, sometimes in the same building suggesting that both surface and subsurface soils were being used in the one area. All brick walls have been observed to be set upon a stone foundation of at least one or two courses in height. Only the roughest building or outhouse was not afforded this treatment. Different sizes of mud brick were created and can sometimes be seen within the same wall. The large, flat bricks generally appear to be an older variety which gradualy gave way to smaller, oblong blocks which probably mimiced the modern standard kiln fired brick. With the larger, flat brick the wall was frequently constructed in one thickness giving a fairly unstable construction which limited the height of the building. Where the smaller bricks were used the wall was of a double thickness although the bricks were generally laid as stretchers with no attempt to bond through the wall with the placement of headers at intervals. Again, this creates a weaker type of wall with limitations on its height and load bearing potential. Window and doorway openings were made without the aid of stone lintels in both mud and stone built houses. Wooden joists were used to span the gap with the remainder of the wall being formed on top of this.

Roofing varied according to local climatic conditions with pitched and tiled roofs being restricted to the mountain areas and flat earth roofs to the lowlands and coastal plains. Even the cities were characterised by flat earth roofs in all but the larger public buildings. Timber rafters, usually no more than 4.0m in length formed the main structural support for the roof and were overlain by mats of bamboo in the better buildings or branches and twigs in the poorer areas. Layers of seaweed or straw have been observed in many buildings to follow this giving a more complete base upon which the soil was spread. White soils are clearly the favoured type of soil cover on roofs although it is frequently underlain by a darker and coarser material. The initial roof was usually no more than max 10.0 cm thick although frequent additions of material, probably on an annual basis, can add a further twenty to thirty layers to the roof resulting in a soil covering of up to 30.0 cm in places. The effects of erosion and damage to the roof can also be seen preserved in places. The fragility of most walls in these houses demanded that special care be taken with detailing at the wallhead in the form of some type of eaves. Timbers were not, on the whole, allowed to project beyond the top of the wall but were rather embedded within the fabric of the wall.This prevented any damage occurring to the valuable roofing timbers from ultraviolet radiation and water saturation. The problem of providing an eaves was solved by extending the roofing material itself beyond the edge of the wall head. In some areas this meant lying the dense brushwood mat that overlay the roof timbers so that it projected slightly and formed the base for roofing soil. A more sophisticated approach involved flat slabs of limestone or gypsum laid along the edge of the wallhead and projecting for 10.0-20.0cm. A lip of soil and smaller stones was often built along this projecting ledge in order to channel the water run-off from the roof into specific areas where ceramic or metal drain spouts were provided. Most roofs were inclined by even a few degrees in order to encourage water to run off, rather than forming damaging puddles, but not enough to allow severe erosion of roof soil. The practice of dividing the roof into segments with the construction of small earth banks can also be seen at times. This is thought to further control the water run off and hinder the removal of sediments from the roof.

Supports for roofs in the dichoro type of house and for verandahs or porches were of a form which is not frequently observed in northern areas. Most timber structural members in the traditional Cypriot house were as peripheral load bearing elements which rarely ever had to withstand the lateral thrust imposed from pitched roofing arrangements. The forces involved in these cases were the downward pressures of the roof or porch. In these cases the strength and stability of the timber uprights was achieved through the weight of the load it supported. As there was no need to bury the lower part of the timber in the ground to give it lateral stability it was accordingly left sitting on the surface or raised slightly above on a stone or small plinth. This had the added attraction of reducing the risks of rot which so frequently afflict earth-fast timbers. This type of arrangement is characteristic of all classes of building in both rural and urban settings.

A2.3 Souskiou Village.

Souskiou lies on the E side of the broad valley created by the Dhiarizos R as it flows S to the sea below Kouklia. The village is located on a higher river terrace on the edge of the flood plain and at the mouth of a canyon deeply incised into the side of the valley below the flatter plateau which extends to the E. The local soils are mainly alluvial deposits from the river as well as some colluvium washed down off the adjacent plateau. The river is one of the few semi-permanent water sources left in Cyprus with stands of water surviving in it for most of the year. It is quite a fertile area with natural stands of reeds and scrubland along the course of the river interspersed with fields and pasture. The river, which has its headwaters high in the mountains of central Cyprus, is also a source of rounded river worn cobbles and stones of the harder volcanic rocks which have been carried down to these lower lying areas. The local stone is a limestone base and there are numerous outcrops of good clay deposits in the area. The villagers of *Souskiou*, therefore, had access to all the necessary raw materials for traditional building construction although the type of trees present in the area meant that roofing timbers tended to be short and twisted. Ingenuity and care, however, overcame this shortcoming.

The village is not a large one and may only ever have housed 500-1000 persons as a rough estimate based on surviving number of houses. The census of 1881 indicates the village population was around 100 rising to 500 by 1946 (Christodolou 1959, 52-55). It had originally been a mixed village although no trace now survives of the orthodox church marked on the map of 1960 (fig. 47). Sculpted fragments of christian iconography can still be seen built into the walls of one of the houses indicating the possible fate of the church. The village obviously has an ancient foundation and has grown and developed considerably during its lifetime. Medieval pottery[1] found in excavation suggests the possible antiquity of the site although no thorough search has been carried out to verify this. By the middle of this century the village had very probably become a mainly Turkish settlement with only a few Greek families or mixed marriage families remaining. Local sources suggest that the village was abandoned in the late 1960s due to the increased internal conflict and violence on the island when the entire village moved to the town of Paphos for protection. The evacuation appears to have been orderly as few possessions were left in the village although the buildings themselves were left intact. After 1974 the Turkish population of Cyprus fled to the N of the island and the Greeks to the S. Few remained in the territory of the opposing group and fewer still have returned to their former homes. Souskiou has never been reoccupied apart from two families which had previously lived in the village. The policy of the Cypriot government was to record the ownership and location of each property in the abandonned areas although it was impossible to carry out any programme of management on such a scale. The houses were left to fall into ruin and are now, largely, beyond recovery. Some scavenging for materials has taken place but on a very limited scale and with the firm disapproval of the authorities. In 1990 with increasing concern for the fate of the cultural heritage in the N, particularly religious monuments and buildings, the government of Cyprus decided to put its own house in order and carry out the restoration of the mosques within its care. The mosque in *Souskiou* was, consequently, restored at this point. Within the past few years the state of collapse of many of the buildings in the village had reached a point where it had become necessary to begin selective demolition in order to keep the roadways clear. Several buildings have been lost in this process and it is likely that more will follow.

The street pattern is unplanned, following the topography of the terrace upon which the village is founded and giving a slightly elongated pattern radiating from a central communal area in which the mosque, school and some shops and coffee houses were located. The streets themselves are

[1]These sherds found during the excavation of Trenches 1-2 at House 162/1 were of a ware which was common in the fifteenth century AD. They were in eroded deposits and may have been derived from elsewhere on the site.

cobbled in rounded river worn stones of the harder rockes washed down from the upper reaches of the river. There is some indication that this pattern of streets has changed slightly over the years.

Houses are of the simple, open courtyard variety with access through an large gate in the wall along one of the streets or lanes. It is apparent that many houses have undergone considerable change in their existence both from the addition of new rooms or upper storeys and from the very evident patterns of structural alteration which can be seen in many of the walls. Ionas (1988, 65) believes this to have been a very poor village, a view which is borne out by the lack of good quality ashlar structures and the almost total absence of modern building types. Only two or three buildings in the village have either reinforced concrete or fired bricks and these all appear to be unfinished. Most of the houses are of the macrinari type facing onto an open courtyard furnished with smaller outbuildings. Only two dichoro houses with stone arches were noted and both are located near the centre of the village where they probably functioned as coffee houses or shops. The school and mosque are slightly grander buildings of a different type of construction more commonly associated with the towns and cities. The majority of the houses are constructed in stone which was readily available and lent itself to a good quality type of coursed masonry set in a mud mortar and secured with small chips of stone. This was generally confined to the main single storied house, ground floor extensions and the courtyard wall. Upper stories and lesser buildings within the courtyard were all constructed in mud brick. Apart from the mosque and the school all the roofs in the village were flat, earth constructions.

House 162/1-2.

Towards the S end of the old part of the village stands a two storey courtyard house, 162/1-2, in an advanced state of collapse but with all its features still in evidence and obviously of some antiquity (fig. 49-54). The combined use of stone and mud brick and the detail of many traditional building elements as well as its great charm set the house aside as an obvious target for research. A study of its constructional history was undertaken in order to try and identify a sequence of erosional events which may have led to the present state of the building. This could then be used to understand any archaeological deposits encountered in the excavations planned for the site.

Description

The house is situated on a bend of one of the main streets in the village and faces S onto a small courtyard opening off an area to the S which appears to be a communal yard (fig. 48-49). A small lane to the E of the house leads into this area. The house is a single room stone built structure, 4.0m x 7.5m, onto which has been built, in mud brick, an upper storey. A further room , also in mud brick, 3.5m x 5.75m, was added to the front of the main room of the house and beside it to the E a staircase leads to the upper floor. Another building in stone, 3.75m x 5.75m, stood across the small courtyard to the S of the house. The entire house complex is now in a very advanced state of collapse with the roofs largely missing from the single storey rooms and much of the E part of upper storey now collapsed into the narrow lane. The constructional history of the house is quite complicated and can only be understood by including the adjacent buildings as well. Frequently evidence is lost or is ambiguous making it impossible to give a definitve assessment of the building, particularly with respect to its earlier phases. It illustrates a history of very poor building practice which must have characterised much of the vernacular building tradition but which is not normally accessible to view. None of the walls has been bonded into adjacent walls even at important corner junctions, materials are mixed within the same wall creating points of erosional weakness, roofing timbers are generally of a poor quality and not enough attention has been paid to the wall heads in the earlier phases of construction. It is this practice of makeshift building development with little reference to existing structural limitations which leaves so many vernacular buildings vulnerable to erosion and catastrophic collpase. House 162/1-164/1 is a fine example of why, even with care, so many vernacular buildings are ultimately victims of the passage of time.

The main room of the house, room 1, is formed from several different walls none of which are bonded into adjacent walls but are built abutting them with straight line joints in evidence. The N wall is a thicker construction than the rest being 0.75m broad and is crudely built of small rubble masonry with over 50% mud mortar. There is a large doorway and a window both of which are now blocked up. The short stubs of the return angles of this wall project N at right angles into the area of the present street. Despite the heavy plastering on the wall it is evident that its outer face is now on the interior of room 1 while its interior face is now exposed to the street side facade. A similar wall also extends to the W of this in House 162/2-164/3. The W wall of room 1 is a well built stone construction which makes heavy use of large water smoothed river stones set in mud mortar. The upper part of the wall has been built up with mud bricks in order to bring it level with the wall head of the other walls. A blocked doorway is still visible in the wall which also appears to abut both the N wall and that of House 162/2. The S wall is heavily covered in a mud render covered with a white lime plaster but is apparently stone built in rubble masonry and abuts that of House 162/2. It has the entrance to the room near the W corner and small window, now blocked, near the central part of the wall. The wall on the E of room 1 has very largely been buried beneath the collapse of the upper mud brick wall. It is, however, a much more complex construction than the other walls. Its outer face is stone built with many dressed and coursed stones being used set in a mud mortar and secured with smaller stone chips. The interior of the wall contains horizontal timbers set at intervals for the height of the wall and its inner face is much more poorly constructed with much smaller stones and more mud being used. The upper course of the wall is also slightly out of alignment projecting beyond the lower courses. The roof of this room had been built using large very irregular timbers which appear totally unsuited for this purpose but which suffice given the skill and ingenuity of the builders. This is overlain by several layers of bamboo many of which have been uprooted rather than cut. A thick layer of soil over this supports the large flat gypsum slabs which form the floor of the upper room.

The upper storey of this room has been built in mud brick and is now heavily eroded. The E end of the building has collapsed entirely and the S wall leans very precariously outwards. It is apparent that this upper floor had also undergone some alterations during its use in the form of an additional few courses of mud brick added to the top of the wall in a brick of a different colour and size. Regular squared timbers have been used for the roof which is several thick layers of mud resting on a bed of bamboo reeds set at right angles to the rafters. Flat slabs project from the wallhead to afford the walls some protection from water runoff.

The front room of the house, room 2, abuts both the wall of the main house and that of the adjacent house. It is built in mud brick sitting on a stone foundation 0.90m high for most of its length. The door jambs and the stretch of wall to the W are built in stone. The roof has been constructed of branches laid across the width of the room onto the wall heads with smaller branches laid at right angles to this. Broken bamboo stalks formed a further layer at right angles to the smaller branches before being overlain by several layers of earth. This roof is very heavily eroded and its collapse is undermining the stability of the upper mud wall. The stretch of wall supporting the staircase to the E of this room is a well built stone structure using carefully selected river boulders set in a mud mortar and supported with smaller pebbles. This is similar to the outbuilding , room 3, which has an obvious inner and outer face with a rubble and mud core. There are no cross-bonding or header stones used in this type of wall construction.

Constructional History

The history of construction of this group of buildings is very complex and difficult to unravel. Its earliest phases have been so reworked as to make an understanding of its development an almost impossible task. At least seven phases of building activity can be detected from the remains as they stand although it is thought that this will simplify things and mask some of the older, poorly preserved phases. This assessment makes no claims about the age of the structures although a fifteenth century AD ware found on the site did point to an early foundation somewhere in the area.

Phase 1. It is evident from the type of walls on the N of the building and from the wall stubs projecting N that earlier structures once stood along the line of the present road. These may also have extended across to House 112 where again wall stubs and the remnants of a stair indicate some sort of structure in the vicinity. Secondary, but of a different construction are the present E and W walls of the present house which may have formed the boundaries of a courtyard extending to the S of the demolished houses with an entrance facing to the W. These buildings are shown on the official map of the village although this does not include a school built in the 1940s-50s and it does include a church which no longer exists.

Phase 2. A small house, 164/3, was built to the W of the courtyard and the entrance to the courtyard was blocked. It is likely that this also signaled the demolition of the original houses to the N and the insertion or widening of the road to its present layout. The shape of the small house also indicates that a building now stood in the position where House 163 stands. House 164/3 was of the dichoro type despite its small size. Its construction entailed the blocking of the entrances to the courtyard to the E as well as to the now demolished house to the N, and the raising of the stone courtyard wall by the addition of several mud brick courses.

Phase 3. The main room of House 162/1 was now constructed as a simple, single storey macrinari type room. All the openings to the N in the old wall were blocked and the courtyard wall to the E was extensively remodelled to introduce a fireplace and an outer facing of better quality masonary. A window and a door were situated at the S of the house facing into the yard. The very small size of the house and the quality of the roof timbers suggest, at this point, that this was the home of quite a poor, or small family.

Phase 4. A front room was added at this point and appears to be contemporary with the insertion of a stairway along its E wall giving access to the roof. Several episodes may be indicated in this phase of construction with the front wall being constructed partly in good quality stonework and also in mud brick. A fireplace was built along the E wall of this room and two cupboards were inserted. It may be during this period that the N or older was room was converted into a byre. The roof of the new room was a fairly poor quality construction with only small, irregular branches and crushed bamboo reeds being used. No windows were included although the large size of the doorway would allow in plenty of light and air.

Phase 5. A period of increased prosperity and expansion is now seen in various structures in the area. Several buildings of good quality masonry were built at this time. The stonework in all these buildings is almost identical and is made from flattish, round edged, basaltic river boulders which are set in a mud mortar with inner and outer faces and a rubble and mud core. These include the outbuilding in House 162/1 at the S end of the courtyard, House 163, and a new House in the N area of the courtyard for House 112 which now became a byre. The wall along the outer edge of the stairway was also built in this style and may indicate a renewal of an older wall. It is probable that this phase also saw the addition of the mud brick upper storey over the original room of the House. The design of this room is of much better quality than the ground floor rooms. The ceiling was much higher, the floor of good gypsum slabs and two windows, one with its wooden grillwork still surviving, were included as well as a row of three small apertures facing onto the yard.

Phase 6. The roof of the upper floor was renewed and raised with the addition of several courses of mud brick distinct from the main structure. Good cut and squared timbers were used for the roof and flat gypsum slabs projecting from the wall head provided a shallow eaves.

Phase 7. The House, and indeed the entire village, was abandoned permanently. None of the furnishings or belongings were left in the houses indicating an orderly departure.

Destructional History

It is apparent that the House underwent a very complex history of building and alteration. Most of this is only visible now that the house is in a state of collapse revealing the types of wall structure and joints that were used. Despite the skill of the various builders of the house it is this process of gradual development which has led to a very unstable and faulted structure.

The agglomeration of rooms tacked on to the side of existing walls or added over older rooms was carried out in such a way that no structural bonds were formed between old and new parts of the building. The presence of straight line joints at almost every point of intersection between old and new is quite obvious in this building presenting many points of weakness which would be readily exploited by any erosional process. This can be seen in many parts of the building where the intersection between two walls, frequently in different materials, has opened up and allowed water penetration into the fabric of the structure with silts building up in the cracks forcing them further apart. The stones walls which have inner and outer faces but no lateral bonding are also subject to destruction once water has penetrated from above and weakened the internal structure. This is most apparent in the E gable where alterations to the main ground floor stone wall and the construction of the mud brick upper room with its walls set slightly back from the edge of the stone wall head has allowed water to run down the wall face into the interior of the stone wall. Its collapse into the lane is the ultimate outcome of this process. In this case a gradual process of erosion over many years has led to a catastrophic failure creating very different types of stratified deposits in that area.

The roofs of the building are obvious areas of erosional attack. The difference in survival of the roof on the upper floor and on the lower S room is quite striking. The upper roof which is fairly well built of regular timbers and with adequate protection along the roof margins is still relatively intact over the area of the room which has not collapsed for reasons outlined above. After thirty years it is still providing some protection to the walls and interior of the room where the plaster on the walls is largely intact. It is significant that the intervening floor has also experienced very advanced erosion and collapse despite being protected for much longer both by the upper roof and by the gypsum floor slabs. This, however, is the roof of the original macrinari house in which very rough, untreated tree trunks and branches were used. The lower roof, however, is in the final stages of decay and collapse with only one small patch of it still in place. The rotting of the timbers of this roof and their collapse into the room have undermined the base of the mud brick upper storey. That, and the loss of part of its roof, are causing the S wall of the upper floor to lean out to the S in an alarming manner. The mud wall of the lower floor, deprived of its protective coverings, has now also adopted the characteristic rounded appearance of a wall subject to continuous erosion. This process has meant that the shape of the mud bricks themselves is now no longer apparent apart from the most recent courses at the top of the upper floor.

Considerable deposits have now accumulated in the courtyard of the house with a well developed fan of eroded material spreading down the stairway into the yard overlying the earlier build up. A complicated series of initial water eroded silts and clays with bands of more consolidated materials from catastrophic failures would be expected in this area. The volume of the material is quite considerable and most probably reflects both the long use of the site and the massive upper parts of the structure which would not be apparent archaeologically. The interior of the rooms was much the same although, here it would be expected that there was a shallower depth of build up. In the oldest room the collapse of the E gable has resulted in the very rapid erosion and collapse of the intervening floor with the timbers splitting in the centre and falling on edge into the room showering it with the flooring material. There is a surprising depth of material in the E part of the room suggesting that the E gable did not collapse in one single episode but at intervals after the floor had given way. This is confirmed by the observation of one episode during the winter immediately prior to the excavation of the site.[2] The floor inside the later, front room was also deep in eroded debris although most of it was apparently from the gradual collapse of the roof in that area as well as from materials brought in through the doorway as the courtyard levels gradually increased.

These types of decay and collapse would be expected to form very distinctive patterns of archaeological deposits. An understanding of how they operate could lead to a clearer identification and understanding of these deposits when encountered in excavation.

A2.4 Building Collapse.

All buildings which do not contain modern materials like cement or plastics are subject to processes of erosion and decay which are continuous and long term. These are the same processes which are in action in the environment at large and which work to reduce the entire structure to its smallest stable natural element. In a village like Souskiou which has been left to the forces of nature for about thirty years these processes can be seen in almost all stages of development. The observation and study of this activity over several years can provide a very full record of what is happening and can show how this is related to the archaeological record. Most of the observations described below come from *Souskiou* although the villages of Theletra, Phikardou and Androlikou are also included.

Various studies and longer term projects have been carried out into formation processes in archaeology which have entailed some degree of understanding of what happens to buildings and how they are affected by environmental conditions. Foremost amongst these has been the work of Michael Schiffer from the University of Arizona. Concerned with the many "...flawed inferential procedures formulated in the era of the new archaeology of the 1960s and 1970s..." (1987, xix) Schiffer embarked on the mammoth task of describing and characterising the effect of human behaviour and natural processes upon the archaeological record. The result was the publication in 1987 of *Formation Processes of the Archaeological Record* which still stands as the largest and most comprehensive work in this field. It is the springboard for any further work although nothing has yet approached it for scale and depth. However, even Schiffer was quick to acknowledge that it was "...neither a complete survey

[2]The effects of the recent earthquake in Cyprus, which measured 5.2 on the Richter scale, are not known at the time of writing. Reports from contacts on the island suggest that considerable damage has been done to some of the deserted villages in the Paphos region and it is unlikely that Souskiou has escaped. Further collpase of some structures is, therefore, likely.

of all topics nor an exhaustive compendium of principles." (1987, xx). As an introduction to the subject and a type of check-list for field workers the publication is invaluable but only close observation and the collection of empiric data can answer the many questions which Schiffer raises. A slightly earlier piece of research by Richard Hughes in dealing with soil constructed buildings attacked this problem from exactly this point of view (Hughes 1983). Coming from a conservation background Hughes was interested in understanding the ways in which a mud building behaved in order to avoid problems caused by restoration or preservation and he was able to do this through his experience of dealing with these buildings. Hughes categorised thirty-seven ways in which a mud constructed building is subject to erosion and decay (fig. 60). These provide a very helpful baseline for an examination of mud building collapse. In W Africa the work of R.J.McIntosh (1974, 1977) and K.Agorsah (1985) further highlighted the need to understand these processes before an interpretation of an archaeological site can be advanced. The present study takes as its starting point the work of these people and using observations of events and conditions in these abandoned Cypriot villages demonstrates how collapse creates archaeological deposits.

There are two general and very different types of collapse which can be observed in action today and these are; catastrophic and non-catastrophic events. Both types can involve natural or human activity and each leaves a very different set of archaeological deposits. The catastrophic event involves an episode of sudden and, usually, devastating collapse or destruction of a building. Earthquake, flood, storm damage or land-slip are some of the better known natural forces involved in this type of destruction. The well known human agencies of such an event include hostile action in war, demolition, or fire-raising. Less obvious are the effects of a change of use of a building which may involve the removal of certain of the buildings features, for example, the roof or internal fixtures. Similar to this is the activity of scavenging or removing useable elements from a derelict property. Each of these events alters the building in a sudden and very dramatic manner exposing it to increased erosional activity and leaving tell-tale signs of the event. In most cases where this happens, large parts of the building survive in a consolidated form buried beneath later collapse. Non-catastrophic events, on the other hand, are generally very gradual processes taking place over many decades or centuries. Most of the processes involved are small scale natural events which are almost imperceptible but are equally destructive and, in the long term, capable of reducing a building to a state which only skillful excavation can identify.

The main non-catastrophic agents of destruction are water, wind, sun, insects, plant growth and animal activity. By far the most persistent and destructive is the action of water in the form of <u>rainwater</u> and ground water. It has been shown above how all mud or earth walls are held together by the action of the internal clay structures which are reinforced by various elements such as calcium or potassium. Water helps to create this bond as well as the structuring of the clays but in excessive amounts begins to break down the structure as the clay particles dissolve into suspension and are removed from the mud in the water runoff. These particles, because of their very small size, are carried some distance away from the wall depending upon the force of the water. The larger particles of sand, gravel or pebbles do not form a cohesive structure on their own and so are readily removed from the wall by various forces such as rainfall, wind or gravity. Their heavier size means they are not carried as far away from the wall as is the clay so that a graded succession of eroded deposits can be seen spreading out from the wall in a broad apron. The most characteristic feature of this type of erosion is the large fan-shaped deposit which frequently occurs at wall intersections or at the base of eroded channels in the wall face. The particle laden water causes furrowing or channel formation at the lowest points of the wallhead particularly along the roof margins, below protruding roof beams and at wall intersections. This type of erosion begins in the upper parts of the building particularly at the wallhead which requires special precautions to protect it from such damage. An unprotected wall, such as a courtyard wall will gradually erode from the top creating a tapered wall profile with a broad apron or talus at its base which will eventually engulf the lower courses of the wall leaving only a broad hump in the ground surface to indicate that a wall once stood in that position. The effect of this action however, is to preserve the lower courses of the wall entombed in the eroded sediments of its upper part. The action of splashback falling at the wall base should also be considered here. Rain falling from the roof or eaves of a house where there are no gutters or drain spouts, falls directly at the base of the wall where it forms a drip trench. The force of the rainfall can disperse sediments accumulating on the ground and can also splash back onto the wall of the house where it can have a dramatic impact on eroding sediments and clays from the wall. This can be seen as a broad band about 0.50-1.0m high where the wall thickness has been reduced by erosion. On walls built on a stone footing this effect is minimal. Stones placed against the base of the wall can also reduce its impact.

The roof has always been an important point of weakness in a building, particularly in one with a flat earth roof. The construction of a flat earth roof has shown how a framework of beams, branches and straw/leaves/seaweed supports several layers of earth and mud. The main bulk of an earth roof is generally made up of a darker poorly sorted soil which acts as an insulating agent but the final layer is composed of a good well-sorted and quite clean layer of clay. On a well maintained roof the clay layer is added to annually in order to replace any material lost through weathering. The clay forms an effective impermeable barrier because of the effect of rainfall which causes the clay particles to bond together and to restructure themselves parallel to the surface thus sealing the roof. However, there is a constant loss of material from the roof throughout the year and without periodic attention this barrier will become increasingly less effective and eventually disappear exposing the rest of the roof to penetrative erosion. Contrary to popularly held misconceptions, the roof does not collapse in a consolidated whole but is rather subject to gradual loss of material eroded off the surface which is carried either over the edge of the wall or down into the building through holes which form between the roofing timbers. The eventual saturation of the roof soils with water instigates rot in the organic roofing materials which eventually decay, starting with the reeds or branches, and collapse showering the interior of the building with the overlying soil burden. Thus characteristic mounds of roofing soils are seen to build up on the floor of the building sometimes mounding in parallel bands which reflect the gaps between the timbers. This material is unsorted and will probably not show any indications of water laminations. The main roof timbers generally begin to rot along the central spine of the room where pressure from the weight of the roof has probably lead to sagging and stress fracturing of the timber. The ends of the timbers embedded in the wall head are generally the last parts to be subjected to rotting as they are still protected by the roof. This situation most commonly leads to the timber beam breaking in the middle, pivotting on the wall head and crashing down into the house in two parts which remain propped up against the wall rather than falling flat onto the floor surface (fig. 53). Their eventual appearance under excavation could be interpreted as a series of postholes lying against the inner face of the wall. Under this type of regime of gradual erosion and decay the classic build up of deposits inside a building with a mud roof would be:

1) The accumulation of fine sediments of air borne particles or finely laminated water laid deposits overlying any post-occupational reuse of the structure.
2) The gradual incorporation of rotted organics and poorly sorted material from the roof. This would include larger gravels and pebbles as well as cultural debris which had been part of the roofing soil.
3) Evidence of timber roofing elements embedded in deposits above the floor and appearing as "postholes" or short stretches of "carbonised" material.
4) The increasing build up of better sorted and more compact clays and silts eroded from the now fully exposed walls. These will develop as an apron extending inwards from each wall face.
5) The presence of larger, consolidated blocks of wall fabric either as patches of mud brick or as blocks of mudwall.
6) General deposits not directly associated with the building but accummulating in the slight hollow or depression formed by the wall stumps.
7) The first stages of the formation of a natural horizonal soil structure.

The build up of these types of deposits are, of course, under ideal conditions and do not forsee the activities of humans or animals which would undoubtedly take place.

The effect of rising <u>ground water</u> is another important consideration in the decay of mud buildings. There is a constant reservoir of water held in the soils and underlying rocks of an area which rises and falls with changing precipitation patterns and temperature conditions. In most areas it is fairly close to the surface and becomes most apparent during the winter months when rainfall excedes the removal of moisture from the ground. A wall built of mud or earth is directly affected by this groundwater with care needed to protect it from the long term effects of rising damp. Wall mud, whether it is mud brick or mudwall is a porous material with many air pockets and hollow casts which form an interconnected network of air spaces. The greater the time spent on the preparation of the mud, the more it is mixed and the greater the number of air spaces that are incorporated in it. This network of spaces acts as a mesh through which water can readily rise through capilliary action. The absorption of water by the clay within the soil wall will also act as a powerful mechanism by which water moves into a soil built structure. The height to which this can rise in the wall is determined largely by the rate of evaporation from the wall surface. In a wall where air is freely allowed to circulate and where there are no impedements to evaporation this is usually within the first metre from the base of the wall. In walls where there is some form of barrier to evaporation this can reach the entire wall height. A build up of deposits against the face of the wall or the application of an impermeable surface coating are the primary causes of this development. It is generally manifested by dampness on the wall and a band of white along the line of the point of evaporation where hydroscopic salts are being deposited. This rising of moisture and deposition of salts within the wall occurs on an annual regime associated with the changing seasons. The result is the continual expansion and contracting of the clays within the wall which can destabilise the structure of the clays setting up stress fractures within the wall. During the winter, when the water content of the wall is at its highest, periods of cold weather and frost can cause freezing, and consequently expansion, of the water trapped in the voids within the wall which further adds to the stress and failure of parts of the structure of the wall. The hydroscopic salts which arrive in the wall dissolved in solution in the water are deposited in the area of evaporation where they form a point of weakness. They draw further moisture into the wall from vapour condensing on the wall surface and are continually undergoing periods of expansion and contraction depending upon the water content in the air. The gradual breakdown of the clay structure within that part of the wall severely compromises its integrity causing spalling and creating a band of disintegrated soils. This has the appearance of a channel or groove cut near the base of the wall which can seriously undermine it frequently leading to collapse (fig 58).

The effects of rising damp penetrating the wall of a building are substantially different from those of water falling against its surface. Moisture within the wall causes long term and not immediately obvious damage. It results in the disintegration of the entire structure of that part of the wall which falls to the ground as an unsorted lump of wall material. If this is buried rapidly by other accumulating deposits or in some other way escapes the effects of rainwater runoff then it will survive in the archaeological record in this form. A narrow band of unsorted material at the base of the wall with some air voids and organic casts from the mud mix still intact may well be an indication of the action of this sort of process

Other elements also contribute to the decay and collapse of a mud building. They do not, however, with the exception of the wind, generally lead to the formation of very specific deposits in and around the structure. The wind is well known for transporting very fine sediments, sometimes for very considerable distances far from their source. The great loess soils which stretch in vast bands across many parts of the world are an indication of how powerful this can be. The dust particles are of the very fine silts and clays and are characterised by a more rounded appearance than sediments which have not been affected by wind action. Like water worn pebbles, the dust particles gain their spherical shape through constant abrasion with other particles while air borne. The greater the sphericity of the particle the longer the distance it has travelled and the greater the abrasion. The identification and categorisation of sphericity is a problematic area and only gross divisions are in any way reliable. On a local scale it may be very difficult to identify sediments which have been transported only a short distance. Areas of sites where structures and topography serve to encourage eddying or a reduction of wind spead will be obvious traps for wind borne sediments. The wind can also aid in the destruction of decaying buildings by setting up vibrations or movement within unstable structures which can hasten their eventual collapse.

Apart from the heating and drying of mud walls described above the main effects of sunlight is in the ultraviolet deterioration of wooden elements of a building. Any timber which has been exposed to direct sunlight takes on a grey, cracked appearance which decays much more quickly. Roofing timbers are particularly vulnerable to this sort of decay and are most evident in the contrast between the interior protected part and the exterior projecting part of the same timber. Insects and animals also have an impact on building decay by destroying organic materials in the building and by burrowing into or under its walls. The full potential impact of an insect infestation of a structure should not be minimalised for the scale of the devastation it can cause. The work of Charles Darwin on the impact of earthworms in the soils around Stonehenge only serves to emphasise their importance (Darwin 1881). In Cyprus conditions do not allow for great earthworm activity although the demolition of any earth-built wall will reveal a wealth of other types of insect communities all actively and relentlessly creating vast networks of passageways, processing sediments and moving soil particles around. The growth of plants on roofs and wall heads can also seriously disrupt the structure and dislodge material. These are mainly destructive rather than formative processes and will not generally be reflected in the archaeological record. In this latter respect water is the key element.

A2.5 The Excavation of House 162/1.

Having examined the construction and layout of the house and proposed a potential history of its disintegration, it was possible to predict the types of deposits which may be expected to occur in and around it. The reliability of this prediction and the confirmation of suggested archaeological deposit structures could only be tested by excavation. It was, therefore, decided that several test trenches should be put down in suitable positions around the house primarily to establish the usefulness of such an approach. Three trenches were, accordingly, sunk into the deposits around the house during the summer of 1990 (fig. 48). Trench 1 was placed in the courtyard hard up against the wall of the house and close to the edge of the fan of material eroding down the stairway to the E. This was situated in order to investigate the types of deposits accummulating from the gradual erosion of known mud brick structures (fig.61). Trench 2 was located inside the single storey lower room running N/S across the room from the main entrance to the entrance to the original room of the house. It was hoped that this exposure would reveal the complete pattern of internal build up and roof collapse as well as material being carried in from outside the house. Its position at the entrances would also allow any future expansion to cut a trench through all the deposits in the house from N to S extending in an unbroken section across the courtyard as well (fig 61). The third trench, Trench 3, was placed against the E gable of the house in the lane where the collapse of that part of the house had resulted in the build up of several types of deposits resulting from both processual and catastrophic events.

Trench 1.

This was a trench 1.0m wide and 1.60m-1.80m in length orientated on the site grid which had been used for recording and drawing the building. The wall of the house was at a slight angle to the trench giving the unequal lengths of the trench. The initial intention was to excavate below the level of the foundations of the house in order to establish earlier formations and depositional histories but, in the event, two cobble courtyard surfaces were encounterd at depths of 0.70m-0.90m and investigation of the lower deposits was left for a future season. The excavation was conducted and recorded in the normal fashion with identifications of stratigraphy being made according to standard archaeological considerations. Twelve distinct layers were recorded although it was obvious at the time that these also included finer layers and lenses which were too fragile or thin to treat separately. A column of sediments was also recovered from the E face of the trench and removed back to Edinburgh where it was examined using a hand held calibrated lens of 10x magnification. The strata are numbered 1-12 from the top of the deposit.[3]

Description

Layer 1.1. A 30mm thick, compact hard and friable buff/brown layer of silts with some organics and large rounded-subangular sands and fine gravels. The lower surface is characterised by concentrations of small rounded grains of heavier silts. There is no apparent internal structure and no voids are present. The clear upper surface is a smoothed layer of finer silts and clays indicating its exposure to water run-off and drying.

Layer 1.2. A 35mm thick, compact, hard and friable buff/brown-grey layer of silts and gravels with some organics and large rounded-subangular sand grains and heavy silts in a finer matrix giving it a sandy appearance. There are no voids but many rootlets and stalk fragments are present.

Layer 1.3. A 25mm thick, hard, friable and compact layer of silts and gravels between two clear cleavage plains on its upper and lower surfaces. There is some evidence of internal weakly developed horizontal laminations made apparent by the orientation of some of the sediments. There are some organics and small rounded gravels which are embedded closely in the fine silty matrix. No voids are present and the layer contains large fragments of wall plaster.

Layer 1.4. A 23mm thick, compact layer of silts containing small- medium sized rounded-subangular gravels and small stone chips fairly loosely embedded in the matrix of fine silts. There are

[3] In these descriptions the classification into clay, silt, sand, gravel and pebble is according to the scheme outlined in chapter 2.1 under the discussion on the soils of the Lemba area. Fine silts are, therfore, closer to 2 microns and coarse silts closer to the 20 microns or 2mm range. Sand is classified as as 20 microns or 2mm with fine sands falling slightly below this size and coarse sands slightly above. This is to reflect the reality that the gradation between coarse silt, sand, and fine gravel is fairly continuous.

few organics preserved although the casts of rootlets are still in evidence. These constitute the few voids present in the layer. The lower surface consists of about 4 very finely laminated layers of sands and gravels with strong horizontal bedding. The upper surface is a smoothed layer of finer silts and clays with no larger silt grains and has been clearly exposed to water run-off and drying.

Layer 1.5. A 37mm thick layer divided into two parts. The upper 20mm consists of a compact hard, blocky layer of silts and coarse sands with some medium-large rounded gravels and pebbles. There is no coherent structure and voids constitute c10% of the total volume. The upper surface is of fine silts and clays smoothed and flattened by water action.

The lower 17mm consists of a series of loosely structured lamina of small gravels embedded in a fine silty matrix. The lamina have a strong horizontal development.

Layer 1.6. A 41mm thick layer divided into two parts. The upper 32mm consists of a hard, compact layer of fine silts and gravels with some small-medium sized rounded-subangular pebbles. Some voids are present constituting <1% of the total volume. Clasts of water laid clays can be seen penetrating from the surface into the main layer. The upper surface is of smoothed fine silts and clays which are quite leveland flat with no coarser grits appearing.

The lower 10mm consists a series of loosely structured horizontally bedded lamina of coarse sands and fine gravels embedded closely in fine matrix of sandy silts and clays. Voids constitute <5% of the total volume and are mainly the casts of rootlets and grains.

Closer to the wall only the upper layer survives and is characterised by many more voids and a distinctive globular structure comprising 20-30% of the total volume. There is no horizontal bedding. This structuring of the clays in such a fashion most probably results from the very rapid drying of heavily charged water run-off.

Layer 1.7. A 55mm thick, compact layer of silts and coarse sands or gravels with some organics in the form of rootlets and decayed grass stalks. Small rounded pebbles and coarser gravels are also present embedded in a matrix of the finer silts and clays. It has a blocky structure with c5% voids. There are clasts of denser clays present and channels containing finer sand particles. This indicates a very roughly sorted material which has probably been subject to quite dramatic water action. The upper surface is of smoothed clays and silts which have been structured horizontally.

Layer 1.8. A 22mm thick layer of coarse rounded sands and small-medium sized subangular gravels closely embedded in a fine sandy/silty matrix which is friable and structured in weakly developed horizontal lamina.

Layer 1.9. A 45mm thick compact and fairly hard but friable layer of coarse rounded sands and medium subangular gravels embedded in a matrix of finer silts and clays. There are some small rootlets present and a few tiny voids forming <1% of the volume. The upper surface is composed of 15mm thickness of laminated layers of fine clays and silts with few coarser elements. It is well smoothed and has strong horizontal bedding. The lower surface consists of loosely laminated small rounded sands and medium subangular gravels densely embedded in a sandy matrix.

Layer 1.10. A 43 mm thick, compact, friable layer of coarse silts and medium subangular gravels embedded in a matrix of finer silts. There are also clasts of fine, reddish silts densely embedded with rounded gravels. The coarser sands and gravels are concentrated along the lower surface in a distinct layer. The upper surface is clear but has not been exposed to any erosion or water action as shown by the absence of any laminations or fine clay layers.

Layer 1.11. A 62mm thick, compact, fairly friable layer of coarse silts with rounded sandy grains and small-medium subangular gravels embedded in a matrix of fine silts. It has a blocky appearance and is weakly structured into horizontal bedding planes. Tiny voids constitute <5% of the total volume of the fabric. There is a concentration of dense consolidated sands on the lower surface while the upper surface is smoothed with some evidence of water action and the formation of a clay skim.

Layer 1.12. A 35mm thick compact, friable layer of coarse silts and sands in a matrix of finer silts and clays. There is no apparent internal structure and voids form c5% of the total volume. The lower 10mm is of finely laminated silts and sands embedded in a matrix of fine silts and clays. The upper surface has been weakly water eroded.

Assessment

The two levels of paving in the courtyard are quite clear in this section although whither or not they represent a general pattern over the entire courtyard is unknown. The lower of the two may extend beneath the foundation of the wall at this point and may represent the yard paving contemporary with the first room of the house to the N. The compact pebbles, gravel and sands overlying this are poorly sorted and incorportate small angular stones which may represent debris from the final construction phases of the house. The upper paving represents the final paving in the yard before abandonment in 1962-5. The deposits which have built up over this, layers 1.1-1.12, therefore, are the result of c30 years of erosion and the formation of archaeological deposits on the site.

This section demonstrates the effects of the different energies of water run-off and erosion on a mud building. High energy deposits are roughly sorted and include larger elements which are deposited near the base of the wall with lower energy activity carrying the finer silts and clays further away to be deposited c1.0m from the wall. This is the natural progression of water as it comes off the wall with greater force which is then quickly dissipated as the run-off flows along the apron at the base of the wall onto the flatter ground near the middle of the yard. Each vertical episode recorded in the section also reflects the high energy run-off at the start of the event with the coarser elements being deposited and the finer ones being carried beyond the excavated area. This is followed by low energy action depositing less structured finer silts incorporating larger elements loosened from the wall and dropping to the ground. Finally, much lower energy activity working on the surface of this material sorts out the finest clays creating a laminated surface. The sequence is typical of most of the layers in the section and reflects the pattern of the most destructive types of storm action in the area with sudden torrential downpours lasting a few minutes and falling on the hard baked ground surface. The initial onslaught of the storm releases large amounts of water which can carry material considerable distances. As the volume of water accummulates into rivulets the flow increases into lowest lying areas and the greatest amount of sorting takes place. The greater bulk of the sediments lossened from the building are deposited at the end of this stage, sometimes in consolidated lumps, but generally in poorly sorted lenses. The final lowest energy flow of water over the deposits occurs as the last of the rainfall runs off the building onto the surrounding ground surface and the finer sediments are sorted and carried along with it.

Nine clear episodes are represented in the section although some obviously incorporate several events. Many more are indicated in the upper strata of the section but are so badly damaged by erosion as to make them difficult to interpret and disentangle. Considering the thirty years interval between abandonment and excavation, though, it is perhaps surprising that more cannot be distinguished. The reasons for this will become clear.

The intitial deposits, 1.10-1.12, lie over and amongst the stones and cobbles of the courtyard where they have been trapped in irregular pockets and hollows created by the stones. The force of the run-off from these early episodes passing over a fairly clean and solid yard surface would probably have flowed for greater distances carrying much of the material further away from the building and possibly even removing some of the more finely sorted elements altogether. This high energy free flowing runoff would gradually become restricted as deposits built up on the courtyard surface creating further obstacles and surface friction to reduce the flow and hence increase deposition. The earliest episodes of erosion may, therefore, be badly represented in the section. The later episodes, 1.5-1.9, are seen to build up more quickly over the established deposits forming a regular and stable apron at the base of the wall. The coarser and more consolidated sediments are deposited immediately at the foot of the wall and the finer clays and silts are carried further out in the yard both of which are clearly evident in the section. There is also a vertical separation of deposits between the lower lenses in each layer where high energy activity is in evidence in the form of almost pure sands and gravels, and the uppermost lenses which are finely sorted and structured clays. These reflect the course of the regimes of the major storm and seasonal activity. It would be wrong to suggest that each layer represents the action of only one season of storms, it is probably far more complicated than that with some seasons producing very little and others quite dramatic increases in the depth of deposits. The latest deposits, 1.1-1.5, are quite different in nature and indicates a sudden change in the configuration of the source of the eroded material. The sudden change in angle of the development of the apron at the wall base can only occur from a dramatic increase in the amount of material being eroded from the building. The collapse of the E gable and the erosion of those sediments down the staircase is the obvious candidate. These episodes have buried the earlier apron which is now no longer subject to erosional activity and hence, is preserved. The new apron which has developed over it, however, is unstable due to the volume of the material and the height from which it has arrived. The steeper angle of slope encourages further erosion of the deposited sediments causing severe truncation. There are probably a further 10 episodes represented in these deposits although the ever increasing angle may mean that no deposition has taken place for a number of years with most of the sediments being carried out into the centre of the courtyard.

Trench 2.

The second trench was placed through the middle of the lower room between the two doorways. It was 2.5m long by 1.0m wide and produced 6 layers of deposits within a depth of 0.43-0.55m. This was excavated down to the clay floor of the house. These were recorded in the standard archaeological fashion and a column of sediments from each deposit was recovered from the E section and removed to Edinburgh for study. They were examined by eye under a hand held calibrated lens of 10x magnification and assessments of sediment type and densities made by this visual identification. The layers are numbered 2.1-2.6 from the top to the bottom of the section.

Description

Layer 2.1. This layer was very badly and intermittently preserved and was recorded only to indicate its presence. It is best represented by a 80mm depth to the E of the section were it appears as a series of strongly laminated lenses. Closer in to the main wall of the house it is less structured and incorporated large pieces of fallen masonry and roofing timbers.

Layer 2.2. A 38mm thick dense, compact layer of fine silts with small-medium havara pebbles and some medium- large angular pebbles forming c10% of the total volume. Organic material in the shape of root and the stalks of grasses prevalent. The upper surface has been weakly smoothed but is quite compact and clear while the lower surface has a globular structure. Closer to the main wall of the house away from the courtyard entrance the layer is thicker and very poorly structured. It contains much recent organic material, stones and wall plaster.

Layer 2.3. A 75mm thick compact but poorly structured layer of fine silts with some medium sized sub-angular pebbles. There are localised patches of weakly structure clay lamina and clasts of a blue/grey-pinkish material with havara flecks. Organics are present as rootlets and decayed twigs with diametres of c10mm. The upper surface has been roughly smoothed and water eroded while the lower surface has concentrations of sandy silts and pebbles although these are not dense.

Layer 2.4. A 50mm thick compact, unstuctured layer of a dense, fine silt matrix with a few medium-large subangular pebbles and patches of whiter clays. Organics are present as rootlets and twigs with diametres of <5mm. The upper surface has been water smoothed while in the lower 3-4mm there is a distinct layer of coarser sandy silts and gravels.

Layer 2.5. A 43mm thick, compact layer of fine silts with few medium-large rounded pebbles and clasts of greenish clay with havara flecks. There is a distinct grainy, globular structure within the matrix as a whole. Organics appear as rootlets and some decayed twigs with diametres of 15mm. The upper surface is a water smoothed lamination of clays with no coarser sediments in it. The lower surface is a 2mm thick layer of rounded sandy silts in a fine silt matrix.

Layer 2.6. A 110mm layer divided into two parts. The upper 40mm consists of a compact layer of fine silts and clays structured into finer lamina with havara flecks. This structure can be seen across the length of the deposit. Organics are present as rootlets and decaying twigs with a diametre of 8mm. Some of the decayed twig casts have been infilled with coarse sandy silts. The upper surface has been water smoothed to form a fine clay skim which preserves the impressions ot twigs, grass stalks and leaves.

The lower 70mm consists of a compact unstuctured layer of fine silts with medium-large subangular pebbles, mainly havara, and rounded coarse sands and gravels. This part of the layer is preserved only near the entrance to the courtyard. No organics survive. The upper surface has been water smoothed to a fine clay skim.

Assessment.

The deposits within the building reflect several episodic events but are far less structured than those outside the house and are therefore less easy to understand. It is not a complete deposit in that the walls and part of the roof are still largely intact. The entire sequence outlined above for predicted internal deposits would, therefore, not necessarily be present. One aspect which is quite noticeable is the failure of the deposits to "mound" near the centre of the room which is very much in keeping with the progress of roof and wall decay. Patches of strongly laminated material do appear near the main doorway in most layers probably indicating sediments being eroded into the room from the outside build up which would be accummulating at a more rapid rate. In the earliest layers there are also laminated deposits near the interior E edge of the room from silts eroded into the room and off of the walls. There is little evidence for deposits carried in through other agencies like wind; the main agent of deposition appears to be water. There is a noted tendency for sediments to form slight banks at either side of the room closest to the walls and at the doorway. This may partly be due to the greater amounts of materials falling at these points but also to the vulnerability of the central area to the effects of water channelling.

It is difficult to say at what point the roof vanished as a protective cover. Certainly there are no timber elements in layers 2.3-2.6. These are quite evident from 2.2 upwards and include the lintel of the doorway which collapsed the year before excavation began. At this point the deposits also take on a less structured appearance and include more plaster, masonry and organic material. It is likely that layer 2.3-2.6 represent the gradual erosion of roofing material onto the clay floor of the room with layer 2.2 indicating the total failure and collapse of the roof bringing down with it some structural material from the upper walls. The uppermost layer, 1.1, which is so badly represented may indicate the reestablishment of more gradual processes of erosion filling in the gaps and hollows left by the catastrophic failure of 2.2. Considering the length of time elapsed since the abandonment of the building, thirty years, it is curious that a more regular, episodic series of deposits have not accummulated. It is obvious that we cannot rely on seeing this sort of development inside a building to become part of the archaeological record. It is also clear that the separation of the deposits into discrete archaeological units may be a fabrication of reality. Each layer quite clearly contains within it evidence of many episodes of erosion which are reflected in the laminated lenses. The layers are only distinguished one from the other by the occurrence of a continuous laminated plane across the section. Yet these demonstrably occur throughout the layers but in a patchier form. The survival of any one lens with a great enough extent to suggest an archaeological layer may be fortuitous and may indicate nothing more than a prolonged dry spell over one summer than a distinct change in pattern. It may be that the only significant depositional difference in this section is the interface between 2.2 and 2.3.

Trench 3.

A trench placed against the E wall overlying the collapse of the E gable in the lane was sunk in order to investigate the effects of burial and collapse on mud brick and to observe the differences in types of deposit from gradual erosional accumulation to catastrophic collapse. In the end, there was not enough time to complete the excavation leaving the latter aim unresolved. However, even the removal of surface deposits was sufficient to reveal the process of erosion and disintegration of the mud brick which had fallen from the gable wall. The greater part of the wall fell in several stages each as a coherent block with all the bricks and mortar preserved. The fall, however, effectively opened the wall up and laid it on its side where erosional activity would be more devastating. Lying arched over the apron of debris at the foot of the gable, the collapsed sections of wall opened up exposing the interface between the various bricks and the mortar. These gaps were very obvious points of erosion into which water and sediments were seen to accummulate breaking down the structure of both the brick and the mortar. The mechanisms by which this is accomplished have been discussed above. The gradual removal of the sediments from both these elements ensured that, despite the great difference in colour, the distinction between them became blurred and it became more and more difficult to distinguish between the two the further advanced the erosion was seen to have developed. There was a gradual, but clear, progression from distinct mud bricks through ghost outline to undifferentiated deposits.

A2.6 Summary.

A clear analogy on the use of building materials and constructional practices has been drawn between the prehistory of Cyprus and its more recent past. Stone, timber, mud, reeds and straw have been used throughout most of history of the island to build the houses and steadings of the majority of the people. Clues about how this may have been carried out in prehistory, for example; types of walling, roofing, roof supports etc. can be derived from traditional buildings and applied to the archaeological evidence. From this it may be possible to understand how prehistoric buildings were constructed.

The natural forces which operate continuously on these buildings can also be studied amongst the ruins of traditional village houses. These forces can be clearly identified and the manner in which they work to cause the disintegration of a building can be assessed. They create very characteristic deposits which can be described and related to archaeological deposits and the formation of archaeological sites. It must always be remembered that each deposit reflects a very complex history which may not always be immediately evident, if at all.

Appendix 3:

Excavations at Kissonerga-*Mylouthkia* 1994-95.

Preliminary Report.

by Gordon Thomas

Two five week seasons of excavations were completed by the Lemba Archaeological Project at the early Chalcolithic site of Kissonerga *Mylouthkia* situated 8 km north of the town of Paphos in western Cyprus. Previous work at *Mylouthkia* by the Project had confirmed the date of the site (c. 3600 BC.) and had revealed the rich nature of its artefact, plant and animal remains[1]. The eroded and damaged nature of the site had also become apparent but, it was hoped that by excavating on land made available away from the eroded coastal slopes information about intact deposits and and possibly even structural remains could be obtained.

A random series of trenches across the excavation area quickly revealed the undulating nature of the prehistoric land surface with structures sitting in large hollows which were protected from later erosion and agricultural activity. A large, well constructed circular building with a diameter of 6.0m and a wall standing to a height of 0.50m was located on the edge of the modern terrace and directly adjacent to a large pit (Feature 5) identified in previous seasons.[2] The wall was 0.50-0.60m wide, constructed of large calcarenite stones with a mud mortar, and faced, on both the interior and the exterior faces with a thick plaster of mud and havara. It is pierced in the SW by an entrance which is furnished with a large flat stone threshold and appears either to have been raised or partially blocked. A second entrance was also located punched through the wall in the NW and may have been created when the primary entrance was blocked. A low semi-circular stone and mud pier projects from the N wall of the building almost immediately opposite the primary entrance and a hearth sits near the centre of the building although this has not yet been completely excavated. Several groups of small ceramic vessels were recovered on the floor of the building in the NW sector, against the E wall and to the left of the main entrance. Other artefacts, including stone tools, lids and figurines, were also found in amongst the pottery. Burnt mud fragments with impressions of reeds and branches were found concentrated in the NW part of the building where linear patches of ash may represent fallen burnt timbers. It is likely that this is derived from the collapse of the roof. There is some evidence, from the raised threshhold and irregularities in the wall, that the building had undergone some sort of rennovation during its lifetime. A series of steeply sloping surfaces built up against the exterior wall may indicate the cause of such alterations. These surfsaces and deposits have accummulated in a broad hollow which is itself founded in an even larger hollow with deposits extending down a further c2.0m below the building. Preliminary examinations of the ceramics and artefacts from the building indicate the structure was in use during the early part of the Chalcolithic sequence, possibly the lattar part of the

EChal period, making this the only building of this period in Cyprus and the earliest known house in western Cyprus.

To the N of the house a second structure set in a 5.0m diameter hollow was located which may represent a domestic installation involved with food processing or preparation. The fragile nature of the remains and their remarkable state of preservation suggests the existence of a roofed structure which could have been supported on an irregular series of postholes cut into the natural havara and earlier deposits but preserved only along the S half of the structure. The main feature of the installation comprised a low bank of mud and clay with, at its W terminal, a small setting of stones and mud supporting a ceramic vessel, and, at its E terminal, a plaster basin constructed of havara clay which had been baked *in situ.* The mud bank enclosed two large socketd stones set firmly into the floor while slightly to the north was a hearth consisting of a burnt and blackened hollow lined with heat cracked stones supporting a large, oval Coarse Ware tray. The base of a pointed flask had been pushed through the floor of the tray and held in position with mud supports. This too had been burnt *in situ* indicating the use of the vessels themselves as hearths. Fragments and complete examples of querns, rubbers and hammers were located around the periphery of the structure. The packing of small heat cracked stones and baked structural mud which filled the entire structure helped to preserve it and may also suggest the nature of its surrounding wall. Installations very similar to this have also been found at the late Neolithic site of Ayios Epiktitos *Vrysi* particularly on floor 2 of House 7.[3] Similarly,at *Philia* Drakos, large socketed stones were found set into broad basins finished in a high quality plaster. [4] Like those at *Mylouthkia* the *Philia* basins were outside the main buildings but were thought by the excavator to have been housed in less robust structures. The relationship of socketed stones, hearths and vessels is also quite common at *Sotira* and their incorporation within a ring or bank of mud is strickingly demonstrated in Houses 11 and 24. [5] The occurrence of such a distinctive structure on an early Chalcolithic site is a significant indicator of links with earlier periods.

A well, revealed in quarrying in the field adjacent to the excavations, was also explored to a depth of over 8.6m. It is c1.0m in diametre, unlined and provided with toe or hand holds cut into the sides at regular intervals which descend to the bottom of the well where it intersects with a small underground stream. Material recovered from the well has so far indicated an early date, most probably in the Chalcolithic period or earlier. The nature of the deposits within the well suggest a deliberate and rapid backfilling of its upper parts and have produced a wealth of palaeobotanical data. A second possible well was also located c20.0m to the S of this and may be investigated in future seasons at the site.

The importance and unique nature of these remains cannot be overstated and it is anticipated that further discoveries and information will be forthcoming from the site. For the first time a stratified sequence related to *in situ* structural deposits has been recovered for the early Chalcolithic period. Buildings, with the possibility of an insight into early Chalcolithic settlement layout, are now also being revealed and have dramatically altered our perception of this mysterious episode in prehistory.

Added to the already rich floral and faunal remains a much more complete picture of the early Chalcolithic period is now beginning to emerge.

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Notes

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2. Peltenburg, E.J. 1980 "Lemba Archaeological Project, Cyprus, 1978: Preliminary Report." *Levant* XII 1-21.

3. Peltenburg, E.J. 1982 *Vrysi, A Subterranean Settlement in Cyprus.* Warminster.

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Appendix 4:

Report on the Analysis of *Kissonerga*-Mosphilia Lime Plaster.

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Recently, I received from Prof. Abraham Ronen from the Haifa University a sample of plastered floor from **B206** at *Kissonerga* Mosphilia. Prof. Ronen asked me to analyse this sample petrographically and to determine its composition.

The analysis procedure followed the methods advocated by Courty *et al* (1989). A block was removed from the sample, where the original organisation and integrity was preserved. Its laboratory preparation for slicing consisted of gradual oven drying in 40-60 centigrade, impregnation with epoxy-resins, a process of polymerisation which lasts about one month and grinding, to prepare the petrographic thin section. The thin section was magnified under a Nikon Labophot polarising microscope at magnifications ranging between 40x and 400x.

Technological examinations of his plaster product by means of petrographic microscopy reveal that it contains high proportions of burnt lime, to which coarse limestone fragments were added. The lime contains contains both complete and fragmentary foramanifera (micro-fossils). This indicates that either the lime burning process was not adequate in temperature or time span, or that some marl was added in order to reduce the amount of burnt lime. Such phenomena are rather common in the cases of Neolithic - Chalcolithic plasters I had the chance to examine.